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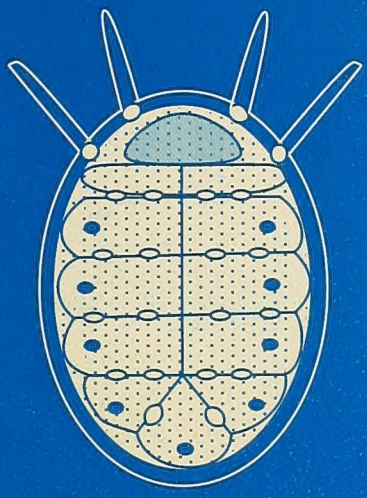

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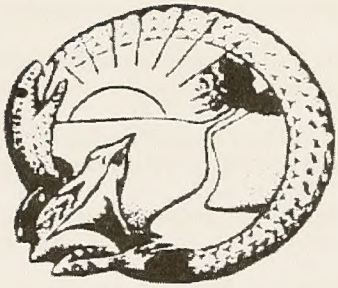

TOMO 74
CONCEPCION
2003

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DE CONCEPCION – (CHILE)
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VOLUME 74 YEAR 2003

SUMMARIES OF TALKS AND POSTERS PRESENTED TO THE THIRTEENTH INTERNATIONAL BRYOZOOLOGY ASSOCIATION CONFERENCE, CONCEPCION CHILE, JANUARY 2004

Edited by Hugo I. Moyano, Juan M. Cancino & María Cristina Orellana

CONTENTS

HUGO I. MOYANO G., JUAN M. CANCINO & MARIA CRISTINA ORELLANA. Chilean Bryozoology **(An introduction to the Conference)**---------- 23

BEATE BADER & PRISKA SCHÄFER. The Antarctic bryozoan *Melicerita obliqua*: Skeletal morphogenesis and growth check lines. **(TALK)**---------- 37

DAVID K. A. BARNES. Life, death and fighting at high latitude. **(TALK)**---------- 38

DAVID K. A. BARNES & PIOTR KUKLINSKI. Bipolar patterns of intraspecific competition and prevalence of homosyndrome. **(TALK)**---------- 39

BJÖRN BERNING, PIERRE MOISETTE & CHRISTIAN BETZLER. Late Neogene bryogeography of southern Spain. **(TALK)**---------- 40

FRANÇOISE BIGEY. Upper Devonian to Lower Carboniferous Bryozoa in Central Hunan (S. China). **(TALK)**--- 42

YVONNE BONE & ROLF SCHMIDT. Basal attachment structure of *Nudicella cribriforma* Schmidt & Bone in the Miocene of Tasmania, Australia, and its similarity to Modern *Adeona* spp. from southern Australia. **(POSTER)**--- 43

ELIZABETH M. CAMPBELL & YVONNE BONE. Cyclostome bryozoans collected during historical Antarctic expeditions are now providing geochemically-determined oceanographic temperature data. **(TALK)**---------- 44

JUAN M. CANCINO, HUGO I. MOYANO & PATRICIO H. MANRIQUEZ. Ecological observations on shallow water marine bryozoans in King George Island, Antarctica. **(TALK)**---------- 45

JUAN M. CANCINO & MARIA CRISTINA ORELLANA. Survival to total overgrowth in encrusting bryozoans. **(TALK)**---------- 46

ROGER J. CUFFEY. Bryozoan Species and Possible Sedimentologic Roles in Small Waulsortian-Like Mud-Mound Bioherms in the Mississippian (Lower Carboniferous of the American Mid-West. **(TALK)**---------- 47

JEAN-LOUP L. D'HONDT. Actualized Biological definition of the Bryozoa. **(TALK)** ---------- 48

JEAN-LOUP L. D'HONDT. The historical collections of Recent Bryozoa in the French National Collections. **(TALK)**---------- 49

LINDA DEER & YVONNE BONE. Bryozoan-sponge associations to bryozoan stable carbonate lithoskels and silica spicules accumulations, to friable limestones with flint layers. **(POSTER)** ---------- 50

YASSER A. EL SAFORI. Environmental impact of the river Nile on the Recent bryozoans of the northern coast of Egypt. (**TALK**)---------- 51

YASSER A. EL SAFORI & AHMED M. MUFTAH. Oligocene bryozoans From al Jabal Akhdar, Libya. (**TALK**)- 52

ANDREJ ERNST & HANS ARNE NAKREM. Bryozoans from the Artinskian (Lower Permian) Great Bear Cape Formation, Ellesmere Island (Canadian Arctic). (**TALK**)---------- 53

ANDREJ ERNST. Lower Carboniferous Bryozoa from some localities in Sauerland (Germany). (**POSTER**)------- 55

ERNEST H. GILMOUR & IRAIDA P. MOROSOVA. Paleobiogeography of Middle to Late Permian Bryozoans. (**TALK**)---------- 56

DENNIS P. GORDON & PAUL TAYLOR. The cheilostomatous genera of Alcide d'Orbigny-nomenclatural and taxonomic status. (**TALK**)---------- 57

ANDREI V. GRISHENKO & SHUNSUKE F. MAWATARI. A new genus of Umbonulidae (Bryozoa: Cheilostomata) from the northwest Pacific. (**TALK**)---------- 58

ASIT K. GUHA & K. GOPIKRISHNA. Diversity, evolution and paleoecology of the Tertiary bryozoan assemblages of western Kachchh, Gujarat, India. (**TALK**) ---------- 59

TEA GLUHAK, PETER HAYWARD, IVAN CVITKOVIC, JANE E. LEWIS & ALEXANDAR POPIJAC. Bryozoan fauna of Green Island, Taiwan – six new species for science. (**POSTER**)---------- 60

STEVEN J. HAGEMAN & CHRISTOPHER D. TODD. Hierarchical sources of environmental variation in a modern bryozoan, *Electra pilosa*. (**TALK**)---------- 61

ECKART HÅKANSSON, SILVIO CASADIO & ANA PARRAS. Miocene free-living bryozoans from Patagonia. (**TALK**)---------- 62

ECKART HÅKANSSON, SILVIO CASADIO & SVEN NIELSEN. Biogeography and phylogeny of the free-living bryozoans in the Miocene of South America. (**POSTER**)---------- 63

URSZULA HARA. Bryozoans from Zechstein (Upper Permian) of southwestern Poland. (**TALK**)---------- 64

AMALIA HERRERA-CUBILLA & FÉLIX RODRÍGUEZ. Morphological description of the setae of four species of the family Cupuladriidae from both sides of the Isthmus of Panama. (**POSTER**)---------- 65

AMALIA HERRERA-CUBILLA , MATTHEW H. DICK, JOANN SANNER & JEREMY B. C. JACKSON. Taxonomy of the genus *Cupuladria* from both sides of of Panama. I. Morphology and Systematics. (**TALK**)------ 66

AMALIA HERRERA-CUBILLA , JOANN SANNER, MATTHEW H. DICK, & JEREMY B. C. JACKSON. Taxonomy of the genus *Cupuladria* from both sides of the Isthmus of Panama. II. Description of the species. (**TALK**) ---------- 67

SAMANTHA HILL & BETH OKAMURA. A novel technique for the assessment of the distribution of *Lophopus crystallinus*, a rare phylactolaemate within the U.K. (**TALK**)---------- 68

VICTORIA B. HOLMES & MARY E. SPENCER JONES. A review of the effects of heavy metal toxicity in freshwater Bryozoa. (**POSTER**) ---------- 69

ROGER N. HUGHES, A. GOMEZ, P. J. WRIGHT, D. LUNT, J. M. CANCINO, G. R. CARVALHO & H. I. MOYANO. Phylogeography and Sibling Speciation in *Celleporella hyalina*. (**TALK**) ---------- 70

TOHRU ISETO. Discussions on the benefit of commensalism in solitary entoprocts (Entoprocta: Loxosomatidae). (**TALK**)---------- 71

JÜRGEN KASELOWSKY & JOACHIM SCHOLZ. Bryozoans and Bryozoa-associated fungi from Galapágos Deep Sea. (**POSTER**) ---------- 72

JÜRGEN KASELOWSKY. Comparison of selected ascophorine bryozoans from Red Sea, Philippines, and Socotra (Yemen). (**TALK**)---------- 73

MARCUS M. KEY, JR., P. N. WYSE JACKSON, E. HÅKANSON , W. PATTERSON & M. DUSTIN MORE. C and O isotopic test of the algal symbiosis hypothesis for gigantism in Permian Trepostomes from Greenland. (**TALK**)- 74

MARCUS M. KEY, JR. & ABIGAIL SMITH. From plate tectonics to bryozoan evolution. (**TALK**) ---------- 75

SANDRA KITTELMANN. Bryozoans from the Jade bight in Northwestern Germany and molecular biological analysis of their associated bacteria. (**TALK**) ---------- 76

PIOTR KUKLINSKI & DAVID. K. A. BARNES. Biodiversity on coastal boulders at Spitsbergen. (**TALK**) ----- 77

PIOTR KUKLINSKI. Bryozoan mode of life in the high Arctic dynamic fjordic environment. (**TALK**)---------- 78

SCOTT LIDGARD. Boreholes, small drilling predators, and reparative growth in fossil cheilostome bryozoans. (**TALK**) ---------- 79

CARLOS Mª LOPEZ-FÉ. Cheilostomate Bryozoa from the Bellingshausen Sea (Western Antarctica): results of the BENTART 2003 Spanish expedition. (**POSTER**)---------- 80

PATRICIO H. MANRIQUEZ, ROGER N. HUGHES & JOHN D. BISHOP. Colonial fusion in relation to coancestry in *Celleporella hyalina*. (**TALK**) ---------- 81

VIRGINIA A. MILLER. Measuring and analyzing morphological complexity in cheilostome bryozoans.(**POSTER**)- 82

PIERRE MOISSETTE, JEAN-PAUL SAINT MARTIN, FRÉDÉRIC GARCIA, JEAN-PIERRE ANDRÉ & JEAN-JACQUES CORNÉE. Bryozoans in Messinian carbonate buildups of western Sardinia, Italy. (**TALK**) ------ 83

PENNY A. MORRIS & DOROTHY F. SOULE. Microbial activity and frontal wall pore sieve plates in northeastern Pacific. (**TALK**) ---------- 85

HUGO I. MOYANO G. Bryozoa of the CIMAR-7 Expedition to the Aysenian fjords and channels. (**TALK**) ----- 86

HANS ARNE NAKREM. Some Upper Permian bryozoans from Svalbard, Arctic Norway. (**TALK**)---------- 87

HANS ARNE NAKREM. Fossil Bryozoa from Svalbard (Arctic Norway) _ a research history. (**POSTER**) ----- 89

ARTURO H. NAVARRETE, JUAN M. CANCINO, HUGO I. MOYANO & ROGER N. HUGHES. Non-reproductive compatibility and morphologic differentiation in *Celleporella hyalina* (Linnaeus 1767) (Bryozoa, Cheilostomata) along the Chilean coast. (**POSTER**)---------- 91

CLAUS NIELSEN. Cell-lineage, larval types and entoproct-ectoproct phylogeny. (**TALK**) ---------- 92

MAJA NOVOSEL, GORAN OLUJIC, SILVIA COCITO & ANTONIETA POZAR-DOMAC. Submarine Freshwater Springs: A Unique Habitat for the Bryozoan *Pentapora fascialis*. (**TALK**)---------- 93

AARON O'DEA . Reproductive life histories of Central American Cupuladriids. (**TALK**) ---------- 94

AARON O'DEA & JEREMY B. C. JACKSON. Coastal seasonality during closure of the Isthmus of Panama. (**POSTER**)---------- 95

BETH OKAMURA & JOANNA FREELAND. Metapopulation ecology of freshwater bryozoans: spatial and temporal contributions to gene flow and genetic diversity. (**TALK**) ---------- 96

BETH OKAMURA, SILVIE TOPS & SAMANTHA HILL. Bryozoans and their mysterious myxozoan parasites. (**TALK**) ---------- 97

MARIA CRISTINA ORELLANA. Freshwater bryozoans in central Chile. (**TALK**)---------- 98

ANDREW N. OSTROVSKY. & PAUL D. TAYLOR. Brood chambers constructed from spines and costae in fossil and Recent cheilostome bryozoans. (**TALK**)---------- 99

ANDREW N. OSTROVSKY & PAUL D. TAYLOR. Ovicell development in the early calloporid *Wilbertopora* (Bryozoa: Cheilostomata) from the mid-Cretaceous of the USA. (**POSTER**) ---------- 100

JOANNE S. PORTER, DAVID O. F. SKIBINSKI & PETER J. HAYWARD. Towards a molecular phylogeny of the cheilostomate Bryozoa; insights from the CO1 and 18s rRNA genes. (**TALK**)---------- 101

ANTONIETTA ROSSO. Bryozoan facies in deep-sea Pleistocene environments of southern Italy. (**TALK**)---------- 102

JUNE R. P. ROSS & CHARLES A. ROSS. Bryozoans near the Ordovician / Silurian Boundary. (**POSTER**)---- 103

JOHN S. RYLAND & JOANNE S. PORTER. Geographic variation in zooid size in wo west European species of *Alcyonidium* (Ctenostomatida). (**TALK**)---------- 104

PRISKA SCHÄFER & BEATE BADER. The genus *Myriapora*: Pathways of evolution. (**POSTER**)---------- 105

PRISKA SCHÄFER & BEATE BADER. Geochemical proxies and life strategies of bryozoans: A comparison of polar and temperate species. (**TALK**)---------- 106

PRISKA SCHÄFER, BEATE BADER & ELENA NIKULINA. Growth pattern and life cycles of the bryozoan *Flustra folicaea*: A comparison of North Sea and Baltic Sea populations. (**POSTER**) ---------- 107

ROLF SCHMIDT & YVONNE BONE. Enigmatic Paleoenvironments of Eocene Bryozoa, St Vincent Basin, South Australia. (**TALK**)---------- 108

JOACHIM SCHOLZ & SHUNSUKE F. MAWATARI. Diversity of laminar bryozoans and microbial fouling on laminar shallow marine bryozoans of Japan and New Zealand. (**TALK**)---------- 109

ABIGAIL M. SMITH & MICHELLE A. BRUNTON. Infestation of a temperate reservoir by freshwater bryozoans – an integrated research programme. (**TALK**)---------- 110

ABIGAIL M. SMITH. Women in the International Bryozoology Association, 1965-2004. (**TALK**)---------- 111

EDWARD SNYDER & ERNEST H. GILMOUR. Bryozoa of the Mission Argillite (Permian), northeastern Washington. (**TALK**)---------- 112

DOROTHY F. SOULE, PENNY MORRIS & HENRY W. CHANEY. Ovicell pores and complex frontal wall pore sieve plates in microporellid species in southern California. (**TALK**)---------- 113

MARY E. SPENCER JONES, JO ANN SANNER & CARMEN S. THOMAS. Bryozoan exchange: Bassler and Hastings. (**POSTER**)---------- 114

MARY E. SPENCER JONES. Biodiversity Aysén, southern Chile: a preliminary bryozoan report. (**TALK**)----- 115

MARY E. SPENCER JONES. History of freshwater bryozoology in the United Kingdom and Ireland. (**POSTER**)-- 116

MARIA ILLUMINATA TATICCHI. Freshwater Bryozoa of Italy I - A survey of the Italian bryozoan collection of A.Viganò. (**POSTER**)---------- 117

PAUL D. TAYLOR & SHUNSUKE F. MAWATARI. Preliminary overview of the cheilostome bryozoan *Microporella*. (**TALK**)---------- 118

KEVIN J. TILBROOK & SAMMY DE GRAVE. Biogeographical analysis of Indo-West Pacific Cheilostome bryozoan faunas. (**TALK**)---------- 119

NORBERT VAVRA. Bryozoan faunas from the Neogene of Moravia (Czech Republic). (**TALK**)---------- 120

LAÍS VIEIRA RAMALHO & GUILHERME MURICY. Taxonomy and distribution of *Bugula* (Gymnolaemata: Anasca) in Rio de Janeiro state, Brazil. (**TALK**)---------- 121

LAÍS VIEIRA RAMALHO & GUILHERME MURICY. Bryozoans from Sepetiba Harbour, Rio de Janeiro, Brazil. (**POSTER**)---------- 122

OLIVER WEIDLICH , ANDREJ ERNST & PRISKA SHÄFER. Early Permian reefs form the southwestern Tethys (Batain region, Sultanate of Oman) - Cool-water evidence confirmed by bryozoan paleogeography, biotic composition, and reef taphonomy. (**POSTER**)---------- 123

JUDITH E. WINSTON & ALVARO ESTEVES MIGOTTO. A New Encrusting Interstitial Bryozoan Fauna from Brazil. **(TALK)**---------- 125

TIMOTHY S. WOOD & MICHAEL LORE. The Higher Phylogeny of Phylactolaemate Bryozoans Inferred from 18S Ribosomal DNA Sequences. **(TALK)**---------- 126

TIMOTHY S. WOOD. Phylactolaemate bryozoans and a new freshwater entoproct from Asia. **(POSTER)**------ 127

ANNA C. L. WOOD, P. KEITH PROBERT & ABIGAIL SMITH. Biodiversity of epifauna associated with bryozoan thickets from Otago Shelf, south-eastern New Zealand. **(POSTER)**---------- 128

EMMY WÖSS. The distribution of freshwater bryozoans in Austria. **(TALK)**---------- 129

PATRICK N. WYSE JACKSON & DINO GANDARA RAI. Bryozoan settlement in borings of the Common Piddock (*Pholas dactylus*) from the east coast of Ireland. **(POSTER)**---------- 130

PATRICK N. WYSE JACKSON & HANS MARTIN WEBER. An exceptionally preserved bryozoan fauna from the Carboniferous (Mississippian, Upper Viséan) of Germany. **(TALK)**---------- 131

KAMIL ZÁGORSEK & KATARÍNA HOLCOVÁ. Development of Badenian Bryozoan fauna in Podbrezice (south , Czech Republic): from reef to meadow. **(TALK)**---------- 132

PROGRAMME OF THE 13th IBA CONFERENCE CONCEPCION, CHILE, JANUARY 2004

REGISTRATION and WELCOME

SUNDAY 11th

15:00 – 18:00 Registration and setting up of posters displays in Aula Magna, Universidad Católica de la Santísima Concepción .

20:00 - 22.30 Opening ceremony and cocktail. Casa del Arte, Universidad de Concepción

ORAL PRESENTATIONS AND POSTER DISPLAYS

MONDAY 12th

I. ECOLOGY and LIFE STRATEGIES

1st. SESSION **Chair DENNIS GORDON**

08:50 – 09:20 **Priska Schäfer** & Beate Bader
Geochemical proxies and life strategies of bryozoans: A comparison of polar and temperate species.

09:20 – 09:40 **Penny A. Morris** & Dorothy F. Soule
Microbial activity and frontal wall pore sieve plates in northeastern Pacific.

09:40 – 10:00 **Sandra Kittelmann**
Bryozoans from the Jade bight in Northwestern Germany and molecular biological analysis of their associated bacteria.

10:00 – 10:20 **Maja Novosel,** Goran Olujic, Silvia Cocito & Antonieta Pozar-Domac
Submarine Freshwater Springs: A Unique Habitat for the Bryozoan *Pentapora fascialis*.

10:20 – 10.50 **Coffee**

2nd SESSION **Chair DOROTHY SOULE**

10:50 – 11.10 **Tohru Iseto**
Discussions on the benefit of commensalism in solitary entoprocts (Entoprocta: Loxosomatidae).

11:10 – 11.30 **Aaron O'Dea**
Reproductive life histories of Central American Cupuladriids.

11:30 – 11:50 **Patricio H. Manríquez,** R. N. Hughes & J. D. Bishop
Colonial fusion in relation to coancestry in *Celleporella hyalina*.

11:50 – 12:10 **Steven J. Hageman** & Christopher D. Todd
Hierarchical source of environmental variation in a modern bryozoan, *Electra pilosa.*

12:10 – 12:30 **Scott Lidgard S.**
Boreholes, small drilling predators, and reparative growth in fossil cheilostome bryozoans.

12:30 – 12:50 **Setting up of poster displays**

13:00 – 15:00 **LUNCH**

3rd SESSION **Chair JUDITH WINSTON**

15:00 – 15:30 **John S. Ryland** & Joanne S. Porter.
Geographic variation in zooid size in two west European species of *Alcyonidium* (Ctenostomatida).

15:30 – 15:50 **Juan M. Cancino** & María C. Orellana
Survival to total overgrowth in encrusting bryozoans.

15:50 – 16:10 **Abigail M. Smith**
Women in the International Bryozoology Association, 1965-2004.

16:10 – 16:30 **Dorothy F. Soule,** Penny A. Morris & Henry W. Chaney
Ovicell pores and complex frontal wall pore sieve plates in microporellid species in southern California.

16:30 – 17:00 **Coffee**

II. AUSTRALASIAN REALM : PAST AND PRESENT

4 th SESSION **Chair MARCUS KEY**

17:00 – 17:20 **Kevin J. Tilbrook** & Sammy De Grave
Biogeographical analysis of Indo-West Pacific Cheilostome bryozoan faunas.

17:20 – 17:40 **Rolf Schmidt** & Yvonne Bone
Enigmatic Palaeoenvironments of Eocene Bryozoa, St Vincent Basin, South Australia.

17:40 – 18:00 **Joachim Scholz** & Shunsuke F. Mawatari
Diversity of laminar bryozoans and microbial fouling on laminar shallow marine bryozoans of Japan and New Zealand.

18:00 – 18:20 **IBA Council Meeting: Hotel Araucano**

TUESDAY 13th

III. ARCTIC and ANTARCTIC: PAST and PRESENT

5 th SESSION **Chair ECKART HÅKANSSON**

08:30 – 09:00 **David K. A. Barnes** & Piotr Kuklinski
Bipolar patterns of intraspecific competition and prevalence of homosyndrome.

09:00 – 09:20 **Andrej Ernst** & Hans A. Nakrem
Bryozoans from the Artinskian (Lower Permian) Great Bear Cape Formation, Ellesmere Island (Canadian Arctic).

09:20 – 09:40 **Piotr Kuklinski** & David K. A. Barnes
Biodiversity on coastal boulders at Spitsbergen.

09:40 – 10:00 **Hans Arne Nakrem**
Some Upper Permian bryozoans from Svalbard, Arctic Norway.

10:00 – 10:20 **Piotr Kuklinski**
Bryozoan mode of life in the high Arctic dynamic fjordic environment.

10:20 – 10:50 **Coffee**

6 th SESSION **Chair HANS ARNE NAKREM**

10:50 – 11:10 **Marcus M. Key Jr.,** P. Wyse Jackson, E. Håkansson, W. Patterson & M.D. More
C and O isotopic test of the algal symbiosis hypothesis for gigantism in Permian Trepostomes from Greenland.

11:10 – 11:30 **Beate Bader** & Priska Schäfer
The Antarctic bryozoan *Melicerita obliqua*: Skeletal morphogenesis and growth check lines.

11:30 – 11:50 **Elizabeth M. Campbell** & Yvonne Bone
Cyclostome bryozoans collected during historical Antarctic expeditions are now providing geochemically-determined oceanographic temperature data.

11:50 – 12:10 **Juan M. Cancino**, Hugo I. Moyano & Patricio H. Manríquez
Ecological observations on shallow water marine bryozoans in King George Island, Antarctica.

12:10 – 12:30 **Mary E. Spencer Jones**
Biodiversity Aysén, southern Chile: a preliminary bryozoan report.

12:30 – 12:50 **Hugo I. Moyano G.**
Bryozoa of the CIMAR-7 Expedition to the Aysenian fjords and channels.

12:50 **Photo Session**

13:00 **LUNCH**

7 th SESSION **Chair PRISKA SCHÄFER**

15:00 – 15:30 **Eckart Håkansson,** Silvio Casadío & Ana Parras
Miocene free-living bryozoans from Patagonia.

15:30 – 15:50 **David K. A. Barnes**
Life, death and fighting at high latitude.

15.50 – 16.20 **Coffee**

IV. GEOLOGY and PALEONTOLOGY

8 th SESSION **Chair ELIZABETH M. CAMPBELL**

16:20 – 16:50 **Patrick N. Wyse Jackson** & Hans Martin Weber
An exceptionally preserved bryozoan fauna from the Carboniferous (Mississippian, Upper Viséan) of Germany.

16:50 – 17:10 **Urszula Hara**
Bryozoans from Zechstein (Upper Permian) of southwestern Poland.

17:10 – 17:30 **Françoise P. Bigey**
Upper Devonian to Lower Carboniferous Bryozoa in Central Hunan (S. China).

17:30 – 17:50 **Ernest H. Gilmour** & Iraida P. Morozova
Paleobiogeography of Middle to Late Permian Bryozoans.

17:50 – 18:10 **Roger J. Cuffey**
Bryozoan Species and Possible Sedimentologic Roles in Small Waulsortian-Like Mud-Mound Biohermsin the Mississippian (Lower Carboniferous) of the American Mid-West.

18:10 – 18:30 **Edward M. Snyder** & Ernest H. Gilmour
Bryozoa of the Mission Argillite (Permian), northeastern Washington.

WEDNESDAY 14th **EXCURSION**

Full day excursion to Nahuelbuta National Park.

THURSDAY 15th

V. FRESHWATER BRYOZOANS

9 th SESSION **Chair JOHN S. RYLAND**

08:30 – 09:00 **Beth Okamura** & Joanna Freeland
Metapopulation ecology of freshwater bryozoans: spatial and temporal contributions to gene flow and genetic diversity.

09:00 – 09:20 **Samantha Hill** & Beth Okamura
A novel technique for the assessment of the distribution of *Lophopus crystallinus*, a rare phylactolaemate within the U.K.

09:20 – 09:40 **Abigail M. Smith** &. Michelle A. Brunton
Infestation of a temperate reservoir by freshwater bryozoans – an integrated research.

09:40 – 10:00 **María Cristina Orellana**
Freshwater bryozoans in central Chile.

10:00 – 10:20 **Emmy Wöss**
The distribution of freshwater bryozoans in Austria.

10.20 – 10:40 **Beth Okamura,** Silvie Tops & Samantha Hill
Bryozoans and their mysterious myxozoan parasites.

10:40 – 11:00 **Coffee**

VI. EVOLUTION and DIVERSITY

10 th SESSION **Chair BETH OKAMURA**

11:00 – 11:30 **Roger N. Hughes, A.** Gómez, P. J. Wright, D. Lunt, J. M. Cancino, G. R. Carvalho & H. I. Moyano
Phylogeography and Sibling Speciation in *Celleporella hyalina*.

11:30 – 11:50 **Joanne S. Porter**, David O.F. Skibinski & Peter J. Hayward
Towards a molecular phylogeny of the cheilostomate Bryozoa; insights from the CO1 and 18s rRNA genes.

11:50 – 12:10 **Timothy S. Wood** & Michael Lore
The Higher Phylogeny of Phylactolaemate Bryozoans Inferred from 18S Ribosomal DNA Sequences.

12:10 – 12:30 **Asit K. Guha** & K. Gopikrishna
Diversity, evolution and paleoecology of the Tertiary bryozoan assemblages of western Kachchh, Gujarat, India.

12:30 – 12:50 **Andrew N. Ostrovsky** & Paul D. Taylor
Brood chambers constructed from spines and costae in fossil and Recent cheilostome bryozoans.

13:00 – 15:00 **LUNCH**

11 th SESSION Chair **PATRICK WYSE JACKSON**

15:00 – 15:30 **Claus Nielsen**
Cell-lineage, larval types and entoproct-ectoproct phylogeny.

15:30 – 15:50 **Marcus M. Key, Jr**. & Abigail M. Smith
From plate tectonics to bryozoan evolution.

15:50 – 16:10 **Paul D. Taylor** & Shunsuke F. Mawatari
Preliminary overview of the cheilostome bryozoan *Microporella.*

16.10 – 16:30 **Jean-Loup L. d'Hondt**
Actualized Biological definition of the Bryozoa.

16:30 – 17:00 **Coffee**

12 th SESSION **Chair FRANÇOISE BIGEY**

17:00 – 17:20 **Dennis P. Gordon** & Paul D. Taylor
The cheilostomatous genera of Alcide d'Orbigny –nomenclatural and taxonomic status.

17:20 – 17:40 **Andrei V. Grischenko** & Shunsuke F. Mawatari
A new genus of Umbonulidae (Bryozoa: Cheilostomata) from the northwest Pacific.

17:40 – 18.00 **Jürgen Kaselowsky**
Comparison of selected ascophorine bryozoans from Red Sea, Philippines, and Socotra (Yemen).

18:00 – 18:20 **Laís Vieira Ramalho** & Guilherme Muricy
Taxonomy and distribution of *Bugula* (Gymnolaemata: Anasca) in Rio de Janeiro state, Brazil.

FRIDAY 16 th

EVOLUTION and DIVERSITY II

13 th SESSION **Chair NORBERT VÁVRA**

08:30 – 09:00 **Judith E. Winston** & Alvaro Esteves Migotto
A New Encrusting Interstitial Bryozoan Fauna from Brazil

09:00 – 09:20 **Amalia Herrera-Cubilla**, Matthew H. Dick, JoAnn Sanner & Jeremy B.C. Jackson
Taxonomy of the genus *Cupuladria* from both sides of of Panama. I. Morphology and Systematics.

09:20 – 09:40 **Jean-Loup L. d'Hondt**
The historical collections of Recent Bryozoa in the French National Collections.

09:40 – 10:00 **Amalia Herrera-Cubilla**, JoAnn Sanner, Matthew H. Dick, & Jeremy B.C. Jackson
Taxonomy of the genus *Cupuladria* from both sides of the Isthmus of Panama. II. Description of the species.

14 th SESSION Chair **JEREMY JACKSON**

10:00 – 11:00 Comments and visit to posters.
Coffee

VII. MEDITERRANEAN-TETHYAN REALM

15 th SESSION **Chair CLAUS NIELSEN**

11:00 – 11.30 **Pierre Moissette**, Jean-Paul Saint Martin, Frédéric Garcia, Jean-Pierre André & Jean-Jacques Cornée
Bryozoans in Messinian carbonate buildups of western Sardinia, Italy.

11:30 – 11:50 **Antonietta Rosso**
Bryozoan facies in deep-sea Pleistocene environments of southern Italy.

11:50 – 12:10 **Yasser A. El Safori**
Environmental impact of the river Nile on the Recent bryozoans of the northern coast of Egypt.

12:10 – 12:30 **Norbert Vávra**
Bryozoan faunas from the Neogene of Moravia (Czech Republic).

12:30 – 12:50 **Yasser A. El Safori** & Ahmed M. Muftah
Oligocene bryozoans From al Jabal Akhdar, Libya.

13:00 – 15:00 **LUNCH**

16 th SESSION **Chair DAVID BARNES**

15:00 – 15:30 **Björn Berning,** Pierre Moisette & Christian Betzler
Late Neogene bryogeography of southern Spain.

15:30 – 15:50 **Kamil Zágorsek** & Katarína Holcová
Development of Badenian Bryozoan fauna in Podbrezice (south, Czech Republic): from reef to meadow.

15:50 – 16:10 **Dennis Gordon:** Species 2000/OBIS

16:10-16:30 **Next IBA Conference Venue**

16:30 – 17:00 **Coffee**

17:00 – 18.00 **IBA BUSINES MEETING**

20:00 – 23:00 **OFFICIAL DINNER**

II. POSTERS

Yvonne Bone & Rolf Schmidt
Basal attachment structure of *Nudicella cribriforma* Schmidt & Bone in the Miocene of Tasmania, Australia, and its similarity to Modern *Adeona* spp. from southern Australia.

Linda Deer &Yvonne Bone
Bryozoan-sponge associations to bryozoan stable carbonate lithoskels and silica spicules accumulations, to friable limestones with flint layers.

Andrej Ernst
Lower Carboniferous Bryozoa from some localities in Sauerland (Germany).

Tea Gluhak, Peter Hayward, Ivan Cvitkovic, Jane E. Lewis & Alexandar Popijac
Bryozoan fauna of Green Island, Taiwan – six new species for science.

Eckart Håkansson, Silvio Casadío & Sven Nielsen
Biogeography and phylogeny of the free-living bryozoans in the Miocene of South America.

Amalia Herrera-Cubilla & Félix Rodríguez
Morphological description of the setae of four species of the family Cupuladriidae from both sides of the Isthmus of Panama.

Victoria B. Holmes & Mary Spencer Jones
A review of the effects of heavy metal toxicity in freshwater Bryozoa.

Jürgen Kaselowsky & Joachim Scholz
Bryozoans and Bryozoa-associated fungi from Galapágos Deep Sea.

Carlos Mª López-Fé
Cheilostomate Bryozoa from the Bellingshausen Sea (Western Antarctica): results of the BENTART 2003 Spanish expedition.

Virginia E. Miller
Measuring and analysing morphological complexity in cheilostome bryozoans.

Hans Arne Nakrem.
Fossil Bryozoa from Svalbard (Arctic Norway) _ a research history.

Arturo H. Navarrete, Juan M. Cancino, Hugo I. Moyano & Roger N. Hughes
Non-reproductive compatibility and morphologic differentiation in *Celleporella hyalina* (Linnaeus 1767) (Bryozoa, Cheilostomata) along the Chilean coast.

Aaron O'Dea & Jeremy B.C. Jackson
Coastal seasonality during closure of the Isthmus of Panama

Andrew N. Ostrovsky & Paul D. Taylor
Ovicell development in the early calloporid *Wilbertopora* (Bryozoa:Cheilostomata) from the mid-Cretaceous of the USA.

June R. P. Ross & Charles A. Ross
Bryozoans near the Ordovician/Silurian Boundary.

Priska. Schäfer, Beate Bader & Elena Nikulina
Growth pattern and life cycles of the bryozoan *Flustra folicaea*: A comparison of North Sea and Baltic Sea populations.

Priska Schäfer & Beate Bader
The genus *Myriapora*: Pathways of evolution.

Mary Spencer Jones.
History of freshwater bryozoology in the United Kingdom and Ireland.

Mary Spencer Jones, JoAnn Sanner & Carmen S. Thomas
Bryozoan exchange: Bassler and Hastings.

Maria Illuminata Taticchi
Freshwater Bryozoa of Italy I - A survey of the Italian bryozoan collection of A.Viganò.

Laís Vieira Ramalho & Guilherme Muricy
Bryozoans from Sepetiba Harbour, Rio de Janeiro, Brazil.

Oliver Weidlich, Andrej Ernest & Priska Shäfer
Early Permian reefs form the southwestern Tethys (Batain region, Sultanate of Oman) - Cool-water evidence confirmed by bryozoan paleogeography, biotic composition, and reef taphonomy.

Anna C. L. Wood, P. Keith Probert & Abigail Smith
Biodiversity of epifauna associated with bryozoan thickets from Otago Shelf, south-eastern New Zealand.

Timothy S. Wood
Phylactolaemate bryozoans and a new freshwater entoproct from Asia.

Patrick N. Wyse Jackson & Dino Gandara Rai.
Bryozoan settlement in borings of the Common Piddock *(Pholas dactylus)* from the east coast of Ireland.

INTRODUCTION TO THE 13TH IBA INTERNATIONAL CONFERENCE

CHILEAN BRYOZOOLOGY

Hugo I. Moyano G.
Departamento de Zoología; Facultad de Ciencias naturales y Oceanográficas. Universidad de Concepción, Casilla 160-C, Concepción, Chile.

Juan M. Cancino & María Cristina Orellana
Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción. Alonso de Ribera 2850, Concepción, Chile.

The study of Bryozoans from Chilean waters started in the 19th century. Two main stages can be recognised on the emphasis of the studies carried out along the 180 years of history. The first one has an almost exclusive emphasis on systematic and taxonomy, while the second, and more recent one, has an emphasis on biogeography, ecology and functional biology. Those two phases are not clear-cut; they do overlap and interact along time.

The years of systematic and taxonomy: The earlier studies were carried out by non-Chilean bryozoologists, mainly Europeans ones, and dealt mainly with marine bryozoans. Such studies include those by Quoy & Gaimard (1824), d'Orbigny (1841-1847), Busk (1854, 1884, 1886), Ridley (1881), Jullien (1888), Waters (1888, 1904, 1905), Calvet (1904a, b, 1909), Kluge (1914), Marcus (1921), Borg (1926, 1944) Hastings (1943), Androsova (1968, 1972), Wiebach (1974), López-Gappa (1978, 1982, 1986), Moyano & Gordon (1980), Hayward & Taylor (1984), Hayward & Thorpe (1987, 1988a, b, c, d, 1989a, b, 1990), López-Gappa & Lichtschein (1988, 1990), Hayward (1988, 1995) and Hayward & Ryland (1990).

Contributions from Chile to the knowledge of bryozoans started with an illustration of a lunulitiform fossil from the Atacama desert (Philippi 1887), which was followed by a 60 years gap without new records or studies. Several Antarctic species were illustrated and described by Mann (1948) from samples collected during the first Chilean Antarctic Expedition. Between 1965 and 1968 Moyano produced a series of papers on littoral bryozoans from Central Chile and others on Antarctic bryozoans collected by Chilean Antarctic Expeditions. In 1969 Viviani's doctoral thesis described 67 ectoprocts and 17 entoprocts of the southeastern Pacific coasts along Chile. Unfortunately most of this large work remains still unpublished (but see Viviani 1969 and Moyano 1991).

From taxonomy to biogeography: In 1972 Moyano reported part of the almost unknown bryozoans from Easter Island, and in 1982 he characterised the Magellanic Bryozoan fauna, including an analysis of the faunistic and zoogeographycal affinities with the Antarctic. This author also added new faunal data from Juan Fernández archipelago and Easter Island in a general comprehensive work on the bryozoans of the Pacific basin including both polar areas (Moyano 1983). Finally, Moyano, in 1991, reviewed the whole Chilean waters bryozoan fauna from a systematic and zoogeographycal point of view.

From biogeography to ecology, functional biology and back to systematics: Overlaping with the interests on large scale bryozoan distribution patterns new topics at local scale and species level started to be addressed, such as homosyndrome (Moyano 1967); polimorphism related to environmental stability (Moyano 1975); chromosomes (Cea & Moyano 1977); epibiosis on animal aand algal substrates (Moyano 1989 and Muñoz & Moyano 1988); phylogeny of Lekythoporidae (Moyano 1985) and predation (Manríquez & Cancino 1991).

In the last two decades of the 20th century two new topics started to be explored, namely the ecophysiology of the bryozoa-algal interaction (Cancino *et al.* 1987; Cancino *et al.* 1991; Molina, *et al.* 1991; Muñoz *et al.* 1991; Manríquez & Cancino 1996;) and the ecophysiology of the bryozoans and its larvae (Muñoz & Cancino 1989; Muñoz et al. 1990; Orellana & Cancino 1991; Ramírez & Cancino 1991; Cancino et al. 1992; Cancino et al. 1994; Orellana et al. 1996; Ruiz et al. 1996; Cancino & Gallardo 2000 and Cancino et al. 2002). Larval release patterns and larval energetics has been one of the most explored topics in this years. Interactions among species have also been investigated, results remain mostly unpublished (Muñoz 1991).

Simultaneously a series of investigations have been carried out anew in subantacrtic and Antarctic areas, such as the Antarctic peninsula, Scotia arc archipelagos, South Atlantic and Cap Horn area which have yielded a lot of new information (Moyano 1996a, 1997a, 1997b, 1999, 2000a , 2000b, 2000c, Moyano & Cancino 2002; Cancino *et al*, this volumen). Among them stand up the proposition of the new cribrimorphan family Polliciporidae, of several new species and genera hitherto unknown in the area.

The bryozoans present in the vastness of the Pacific area between Arica, Easter island and Cape Horn are also been addressed anew. Preliminary studies resulting from recent Chilean Navy's CIMAR Expeditions to oceanic Chilean archipelagos lying on the Nazca plate, have yielded new records of the Indo-Pacific bryozoan fauna reaching Desventuradas islands. This means new families, genera and species for Chile and the science and the unexpected zoogeographical relationships between the eastern and western central Pacific. (Moyano 1973, 1983, 1985 a, 2002 a).

The ecophysiological studies carried out in Chile in the last two decades have used mainly the hitherto regarded as a cosmopolitan species *Celleporella hyalina* and its larvae. These studies have produced a series of joint Chilean-British publications (see above references), which started with the work by Cancino for his doctoral thesis in Wales (Hughes & Cancino, 1985; Cancino 1983, 1986; Cancino & Hughes 1987, 1988) and the more recently one by Manríquez (2000). At this Conference we will be hearing the results of the last British-Chilean joint research project carried out on this species (see Hughes *et al.*, and Navarrete *et al.*, this volume). The results of molecular genetics and inter-population breeding experiments are demanding from taxonomist to tell species apart but with the new challenge of knowing that they are dealing with a set of cryptic species. Therefore we are back to taxonomy, where all started for Chilean bryozoology.

Phylactolaemata: Bryozoans from Chilean freshwaters are almost unknown, the only existent studies are those of Calvet (1904) and Wiebach (1974) on the Phylactolaemata from the Magellan zone. Recently Orellana (1999) has undertaken the study of this group, based in which Wood (2001) reported a new species for Chile. The study of this group remains mainly on the phase of systematic, although the study by Orellana has started to explore into the ecology.

Paleontology: Most of Chilean geological studies have dealt with economy and not with paleontology, therefore studies on Chilean fossil bryozoa are scarce, little known or inexistent. Corvalán (1965) in a review of Chilean Geology indicates for instance, the presence of Fenestellid bryozoans in the Juan de Morales formation (Upper Carboniferous) in northern Chile. In Concepción area stand up the Quiriquina Formation (Upper Cretaceous) and Tubul (Pliocene). Quiriquina formation with its richest molluscan fauna has been comprehensively studied (Stinnesbeck 1986). Its cyclostome bryozoans have been shown once through a poster presentation in the national annual geology meeting.

Such is the stage of the knowledge of bryozoans in Chile at the time we welcome the international bryozoologists attending the 13th IBA Conference in Concepción, Chile. A total of 83 contributions, 65 talks and 23 posters, will be presented in this Conference, covering almost all the disciplines of the contemporaneous biological science applied to bryozoans. As part of the Conference a group of Bryozoologists from many nationalities will visit most of Chile. Samples collected as part of these trips are likely to produce new advances to Chilean bryozoology.

As a way of leaving a lasting testimony of this unique event for Chilean bryozoology we are glad to publish this presentation and all the abstracts of talks and posters as vol 74 of the Boletín de la Sociedad de Biología de Concepción

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ABSTRACTS OF TALKS AND POSTERS.

The Antarctic bryozoan *Melicerita obliqua*: Skeletal morphogenesis and growth check lines

Beate Bader & Priska Schäfer

Institut für Geowissenschaften, Abt. Geologie/Paläontologie, Universität Kiel, Ludewig-Meyn-Strasse 14, D-24118 Kiel, Germany

Melicerita obliqua is a common endemic species on Antarctic shelves. The colonies are bifoliate-flattened and sabre-shaped, and attached with organic rootlets in the sediment. The most significant feature of the skeletal morphology is the segmentation of the colony which indicate annual growth check lines. Formation of check lines occurs as a combination of thickened walls in the proximal part of the nodal autozooid and an oblonged, thin-walled distal part. Both are separated by a back-fold of the frontal cryptocyst resulting in a narrow slit on the cryptocyst. Changes in the length of autozooids and segments indicate seasonal and inter-annual variations in the environmental factors.

The length of segments varies within a single colony but shows a slight decrease with colony age. Individual colonies of *Melicerita obliqua* reveal a maximum age of about 45 yr. Seasonal growth patterns in the colony are expressed in segment formation with nodes and internodes and differences in autozooid length. Variations in colony growth rate calculated from length increment of segments depict a pattern of longer and shorter segments corresponding between individual colonies thats suggests a high-order cyclicity in primary producitvity and sea-ice cover.

Life, death and fighting at high latitude

David K. A. Barnes

British Antarctic Survey, High Cross, Madingley road, Cambridge, CB3 0ET dkab@bas.ac.uk

In earth's history, having two frozen polar regions is unusual. Not only do these regions experience extreme light climates and associated primary productivity, but freezing sea temperatures and seasonally intense UV irradiation. At these high polar latitudes severe wind speeds, wave action, ice scour and anchor ice (as well as massive fresh water runoff and localised anoxia in the arctic) make the nearshore environment the most disturbed anywhere. On land, in fresh water and in the intertidal zone there are few colonist species but just a few meters deeper in the sea there can be rich, diverse and abundant benthos even in shallow water. The severity of the physical environment is reflected in the interactions in the biological sphere. Amongst the most abundant shallow water benthos are lithophyllic polychaetes, bryozoans and sponges and in these communities its overgrow or be overgrown. The organisation of sessile animals is extremely hierarchical: at any given locality one species is overgrown by all others and one species overgrows all others – everyone else occupies a rank in between.

With no keystone predators to remove competitive dominant species only the catastrophically destructive power of ice and waves prevents monoculture of certain species. In ice-sheletered areas, such as crevices the end point of classically envisaged 'succession' can be seen. In these shallow water environments many animal populations display exactly the converse of characters typically associated with the polar regions. The most abundant species of many clades are the rarer broadcast spawners with pelagic larvae, that grow and reproduce fast (for polar animals) are small and have but brief lifespans. Many of these contrasts can be seen in the representatives of just one phylum – the Bryozoa. Rather than the predicted K selected species of deeper waters the shallows are ruled by lightly calcified pioneers. Here ecological and evolutionary success have become very much decoupled. A ~2°C rise, predicted in polar waters, could be enough to transform this unique zone

Bipolar patterns of intraspecific competition and prevalence of homosyndrome

David K. A. Barnes

British Antarctic Survey, High Cross, Madingley road, Cambridge, CB3 0ET dkab@bas.ac.uk

Piotr Kuklinski

University Courses on Svalbard (UNIS), P.O.Box 156, Longyearbyen N-9171, Norway Institute of Oceanology, Polish Academy of Sciences, Marine Ecology Department, ul. Powsta_ców Warszawy 55, Sopot 81-712, Poland.

Polar shores probably represent the most dynamic and intensely disturbed environments on the globe. Nevertheless intense battles amongst sessile organisms for space are commonplace on hard substrata. Typically assemblages are very young and competitively inferior but fast growing species occupy most space. As a result most competition tends to be intraspecific, though it is interspecific competition which has received the great majority of scientific attention. In this study we examine intraspecific encounters in numerically dominant, encrusting species at the high arctic latitudes of the Faeroes (63°N), Hornsund (77°N) and Ny Alesund (79°N) in Spitsbergen. We also measured the same data at the Antarctic localities of Signy (60°S), Dobrowlski (65°S) and Adelaide islands (68°S). Earth's two polar regions differ substantially in geological history, geography, bathymetry and biodiversity, but have some important similarities – competition structure seems to be one of them. We found strong similarities in the importance, nature and outcome of intraspecific interactions. In each location the vast proportion of intraspecific interactions occurred in just one species. Most encounters involved colonies meeting 'head-on' and resulted in ties rather than decided (win or loss) results. The relatively fast growth of the pioneers dominating all six study sites meant that many individuals experienced crowding, restricted growth and accelerated ovicell production due to intraspecific competition. Homosyndrome (fusion) was rare but their frequency differed significantly between competitor identities. We found that aggressive species (with high interspecific rankings) were more likely to tie in interspecific meetings and undergo homosyndrome. Furthermore species in higher water flow environments were less likely to show tied interactions or homosyndrome. We interpret these findings and their implications in the context of changing disturbance and climate patterns.

Late Neogene bryogeography of southern Spain

Björn Berning

Geologisch-Paläontologisches Institut, Universität Hamburg, Bundesstr. 55, 20146 Hamburg, Germany

Pierre Moissette

Université de Lyon I, UFR Sciences de la Terre/UMR CNRS PEPS, 27 Bd du 11 novembre, 69622 Villeurbanne Cedex, France

Christian Betzler

Geologisch-Paläontologisches Institut, Universität Hamburg, Bundesstr. 55, 20146 Hamburg, Germany Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, UK

Even 30 years after the discovery of the latest Miocene desiccation of the Mediterranean Sea, an episode known as the Messinian salinity crisis, the circumstances of this impressive event are a subject of much debate. Since Mediterranean bryozoans show a great diversity and are well preserved in late Neogene sediments, they have already played an important role in deciphering evolutionary and biogeographical consequences of the crisis to Mediterranean faunas. Nevertheless, many questions concerning the paleoceanography or paleobiogeography remain as yet to be answered. One major drawback lies in the fact that, while bryozoans from the Mediterranean Sea itself are quite well known, there are merely few data from regions west of the Strait of Gibraltar, i.e. of the Atlantic realm, which might have served as a refuge for the Mediterranean biota during the crisis. Here we present hitherto undescribed bryozoan faunas from southern Spain of the Atlantic Guadalquivir Basin (late Tortonian) as well as the Mediterranean Agua Amarga Basin (Tortonian/ Messinian) and Carboneras Basin (Lower Pliocene) to record environmental and biogeographical disparities in these different regions before and after the crisis.

Our new systematic and biogeographic data allow us to address several aspects. (1) The occurrence of species of Mediterranean affinity (e.g. *Myriapora truncata*) in sediments of the Guadalquivir Basin provides evidence for a westerly direction of surface water flow through the Rifian and/or Betic gateways before the onset of the crisis. This observation is confirmed by Tortonian-Messinian current-indicative sedimentary structures preserved within the Spanish straits. The late Miocene dispersal of taxa thus differs from the modern situation in that today a westwards migration of shallow-water Mediterranean biota is prevented by the constant inflow of surface water from the Atlantic through the Strait of Gibraltar. (2) The fact that several species endemic to the Mediterranean survived the salinity crisis indicates the presence of a contemporary refuge providing environmental conditions sufficiently similar to the Mediterranean Sea. Since the bryozoan fauna of the Guadalquivir Basin is comparable to the Mediterranean ones, this basin qualifies to have served as such a retreat. However, some species of the Guadalquivir Basin differ significantly in colonial or zooidal morphology from their neighbouring Mediterranean representatives which might suggest environmental boundary conditions for the existence of some Mediterranean species in this peripheral region. (3) The huge set of data resulting from past and

ongoing research on Neogene bryozoans from the Mediterranean realm, in which over 400 species are known to occur, provides a sound basis to statistically evaluate the processes and patterns of evolution, extinction and migration. In particular, the valuable information that we have gained from a marginal part of the late Miocene Mediterranean Sea, the Guadalquivir Basin, allows us to reconstruct the evolutionary history of Neogene to Recent Mediterranean bryozoans and the impact of the Messinian salinity crisis on the biota of the region.

Upper Devonian to Lower Carboniferous Bryozoa in Central Hunan (S. China)

Françoise P. Bigey

Université P. & M. Curie (Paris VI)

Département de Géologie Sédimentaire, Laboratoire de Micropaléontologie C. 104. 4, Place Jussieu F-75252 Paris-Cédex 05, France.

The considered region of Central Hunan Province is located in the Lengshuijiang-Xinshao-Qiyang area. It consists of a part of the tectonic South China Fold System. Continuous sedimentation during late Paleozoic has to be underlined. Consequently this area is especially valuable for study of Frasnian-Famennian event and Devonian-Carboniferous transition beds. Conodonts and foraminifers chiefly give precise bio-stratigraphical data. The littoral and shallow environment favours widely the development of benthic fauna: rugose corals, stromatoporoids, brachiopods, echinoderms in addition to bryozoa. According to the preservation conditions, accuracy in identification of zoaria remains unsteady.

From the four sections studied by Chinese and Belgian biostratigraphers, three of them have yielded bryozoa. Laojiangchong section: Frasnian to Famennian, Oujiachong section: Famennian and Malanbian section: Famennian to Tournaisian. Within the Laojiangchong section, the late Frasnian Laojiangchong Formation corresponds to the richest levels for bryozoa: numerous ramose trepostomate colonies are present. Higher in the section, within Tuzitang Limestone (base of the Famennian Xikuangshan Group), bryozoa are more diverse: trepostomes (branched or encrusting) and rhabdomesids. Within the Oujiachong section the last levels of the Magunao Limestone (top of the Famennian Xikuangshan Group) bryozoa are chiefly rhabdomesids, but some encrusting trepostomes exist. Within the Malanbian section, bryozoa are known from nearly all Formations. Within the Famennian Shaodong Formation, the scarce bryozoa are trepostomes and rhabdomesids. Within the uppermost Famennian Menggongao Formation are found some encrusting trepostomes and rhabdomesids; fenestellids appear. Within the Tournaisian (Hastarian) Tianeping Formation, fenestellids dominate ramose trepostomes. Within the Tournaisian (Ivoirian) Doulingao Formation, the last Carboniferous one of the area bryozoa are more diverse, fenestellids, rhabdomesids and few trepostomes and fistuliporids.

Value is attached to occurrence of bryozoa in Famennian levels, as in South China, because rare elsewhere. Meanwhile bryozoa are not directly involved in the Frasnian-Famennian event and the Devonian-Carboniferous boundary because lacking in the concerned strata.

Basal attachment structure of *Nudicella cribriforma* Schmidt & Bone in the Miocene of Tasmania, Australia, and its similarity to Modern *Adeona* spp. from southern Australia

Yvonne Bone

Geosciences, School of Earth & Environmental Sciences, University of Adelaide, Australia, 5005

Rolf Schmidt

Museum Victoria, PO Box 666E, Melbourne, Victoria, Australia, 3001

The large onychocellid cheilostome bryozoan, *Nudicella cribriforma* Schmidt & Bone (in press) has until early 2003, only been found as fragments of the feeding portions of the erect bilaminar foliaceous colony, i.e. pieces with zooids on a cribrate fenestrate sheet. This architecture is reminiscent of Modern *Adeona* Lamaouroux species, with this similarity particularly relating to the large fenestrules (up to 2 mm in diameter) present in both taxa.

There had been no recovery of definite basal attachment structures of any *Nudicella* until recently. *Adeona* spp. are amongst the most successful bryozoans in terms of weight and/or volume in their preferred environment of mid- to outer-shelf unconsolidated sediments, particularly at depths of 60 – 120m. This success probably stems from its complex attachment structure, which is a robust, trunk-like, kenozooidal basal section that is usually buried up to 5 cm into the sediment. This trunk becomes branch-like in the section of the colony above the sea floor, whereas the subsurface section is root-like, with the tips of the roots extending into the sediment to a depth of a metre or more, as mucilaginous strings. The kenozooids in the trunk and root sections are articulated by connecting chitin-like material. The whole attachment process allows the bryozoan to be a pioneer exploiter of an open-shelf, high-energy environment that is otherwise poorly colonised by sea-floor biota. It then acts as a substrate for secondary settlers, e.g. the cellariids and articulated zooidal forms. The presence of a hardground, however, sees *Adeona* cement itself to the substrate, even if it is only a few cm in length, thereby not producing the bulk of the roots nor the mucilaginous strings, but still retaining the flexibility of the articulated kenozooids of the trunk section.

The cribrate growth form occurs commonly and convergently throughout the bryozoan fossil record, so we assumed that *N. cribriforma* had a rigid basal structure similar to most other fossil cribrate species, although it had never been found. Then in February, 2003, at Marramah on the western coast of Tasmania, in the Miocene limestone, a large specimen of *N. cribriforma* was found, complete with the kenozooidal attachment structure and the anastomosing roots. It was associated with the same diverse fauna that we find it associated with in South Australia, which is similar to the modern southern Australian shelf.

Adeona uses aragonite to produce its skeletal structure today. *N. cribriforma* did not appear to use aragonite, as the specimens are generally not dissolved like those other co-occurring organisms which did use aragonite, even when the colony has fragmented into individual zooids. This raised the question of why none of the basal trunk sections have previously been found, as they should survive diagenesis, unless the colony was bi-mineralic and used aragonite for the basal section.

Cyclostome bryozoans collected during historical Antarctic expeditions are now providing geochemically-determined oceanographic temperature data

Elizabeth M. Campbell & Yvonne Bone

Geosciences, School of Earth & Environmental Sciences, University of Adelaide, Australia, 5005.

Geochemical analyses of $d^{18}O$ values from calcareous fossils are widely used to calculate the paleotemperatures of the ambient ancient ocean water. Brachiopods and suitable foraminfers are commonly used, but these are not always available. It is also possible, however, to use low-Mg calcite (LMC) bryozoans as proxies for oceanographic parameters. Cyclostome bryozoans predominantly use LMC for their skeletal elements so this makes them especially useful.

None of the expeditions to Antarctica in the period 1901 to 1937 had the collection of bryozoans as a major goal. These expeditions were financed for entirely different reasons, e.g. the BANZARE expeditions (Mawson *et al.*), the *Discovery* cruises, Scott's cruises, were investigating krill for the whaling industry, investigating and mapping onshore areas, producing navigation charts and Empire-building. Nevertheless, these leaders had the foresight to dredge sea-floor for biota and sediments whenever the opportunity arose. They lived at a time when the collection and diligent archiving of the material obtained was considered a "proper pastime" for all educated gentlemen, and indeed, also a fascinating one.

So, the world has repositories of historically-important biota collections that have been subjected to at best, a first-pass sorting. Few of the collections have been studied to the species level. Instead, they have been sitting in such locations as the basements of Museums around the world, awaiting the right time to be accorded their place in the scientific assessment and cataloguing of the diversity, distribution and density of the marine biota.

It is in such Antarctic collections we have found a treasure-trove of cyclostome bryozoans. Our research has been:

I. to investigate the historical nature and collection methods of the expeditions, and to record this information for posterity

II. to separate out the cyclostome bryozoans, and note their associated biota, if possible

III. to identify the cyclostomes to at least genus level and where possible, to species level

IV. to determine their mineralogy by XRD and their stable $\delta^{18}O$ and $\delta^{13}C$ isotope values.

We have limited our research to the stations that are at latitudes south of 60°S, and which are usually within a depth range of 20 – 600 metres. We plan to compare these results at a later date with cyclostome bryozoans from comparable stations along the margin of southern Australia, as bryozoans have been major contributors to the carbonate sediments on the polar and temperate sea floors throughout the Cenozoic.

This paper focuses on the historical aspect of the research.

Ecological observations on shallow water marine bryozoans in King George Island, Antarctica

Juan M. Cancino

Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción. Alonso de Ribera 2850, Concepción, Chile.

Hugo I. Moyano

Departamento de Zoología, Facultad de Ciencias Naturales y Oceanográficas, Universidad de Concepción.

Patricio H. Manríquez

Estación Costera de Investigaciones Marinas, Facultad de Ciencias Biológicas, Pontificia Universidad Católica de Chile.

With the aim of contributing to the knowledge of both, bryozoan species diversity and reproductive biology of some selected species of shallow water bryozoans in Antarctic waters, different substrata were sampled in Fildes Bay (62°, 11' 52" S, 58° 55' 57"W). Samples were collected by scuba diving in January 2003, at depth ranging between 7 and 20m, brought to the laboratory and kept in running seawater until studied under the binocular microscope.

A total of 28 species, 7 Cyclostomes and 21 Cheilostomes were found. Bryozoans occurred on red algae (2 to 8 species, depending on algal species); on foliose Bryozoa (3 to 11 species), on invertebrates (Porifera, Brachiopods, solitary ascidians and Hydrozoa, (2 to 7 species) and on rocks (9 species). Dominant species were *Inversiula nutrix* on rocks, *Celleporella bougainvillei* and *Osthimosia milleporoides* on animals and algae, *Celleporella antarctica* on thin filamentous substrata. *Celleporella bougainvillei* was widely distributed on red seaweed, while *Celleporella dictyota* was found mainly on the stipes of *Desmarestia* sp. Fourteen out of the 21 Cheilostome species were endemic to Antarctica (66,6% endemism), while the other 7 are also present in the Magellan area.

Size at first reproduction was smaller in *Celleporella antarctica* (8 autozooids) than in *Celleporella bougainvillei* (19 autozooids). Fecundity (sexual zooids/autozooids) was under 0.2 for *Nematoflustra flagellata*; ranged between 0.05 and 0.37 for *C. bougainvillei* and between 0.1 and 0.75 for *C. antarctica*. These results are discussed in relation to the nature of the substratum used by the different species and compared with published information of similar species in temperate waters. INACH Project 05/97.

Survival to total overgrowth in encrusting bryozoans

Juan M. Cancino & María Cristina Orellana

Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción. Alonso de Ribera 2850, Concepción, Chile.

Overgrowth is common among colonies of encrusting bryozoans. Total colonial overgrowth occurs mainly when small colonies of species get into contact with the fast growing edges of larger colonies. The totally overgrown colony has usually been regarded as dead. In the present study we determined whether the colonies totally smothered by others are actually dead.

Encrusting bryozoans were grown in 132 cm^2 glass slides kept during 3 months in the subtidal, allowing natural settlement and overgrowth to take place. The glass slides were photographed weekly and afterwards all the colonies that had been totally overgrown were exposed by carefully removing the overgrowing colonies. We registered the initial number of totally overgrown colonies per species and the number of such colonies having active zooids 1 week after the experimental removal of the smothering colony.

Three hundred thirty five total overgrown colonies, of the 7 commonest encrusting bryozoans species in central Chile, were studied. Between 28 and 80% of the colonies of these species survived to total overgrowth. Ability to survive total overgrowth was present in species of a wide range of competitive hierarchies, suggesting that this is not a mechanism present only in species that are more likely to be overgrown due to their low competitive hierarchy. According to the present results, totally overgrown colonies should be regarded as dormant rather than death. More information is required to assess the role of such dormancy in encrusting bryozoans community structure.

Bryozoan Species and Possible Sedimentologic Roles in Small Waulsortian-Like Mud-Mound Biohermsin the Mississippian (Lower Carboniferous)of the American Mid-West

Roger J. Cuffey

Department of Geosciences (412 Deike Bldg.), Pennsylvania State University, University Park, Pennsylvania 16802, USA

Bryozoan reefs have a lengthy geologic history (Ordovician – Recent), during which their importance has fluctuated greatly. The earlier Mississippian (earlier Lower Carboniferous) was one time when such structures were conspicuous, in the form of mud-mounds in part possibly baffled or stabilized by fenestrate bryozoans, deposits long known in western Europe as the Waulsortian facies.

Similar, but not identical (hence instead often termed "Waulsortian-like"), bioherms have been studied in the Mid-West (from Kentucky to Missouri, and Illinois to Tennessee). These American build-ups, in contrast to the European ones, are smaller-sized, coarser-grained (calcisiltite), in shallower paleoenvironmental settings, and include not only carbonate but also argillaceous compositions.

Bryozoan fossils are scattered through these mounds, mostly fragmentary, lying frontal-surface downward and horizontally parallel to bedding, but locally intact and preserved still standing upright within the entombing mud sediment. In total, 62 bryozoan species (out of the several hundred described from the region in similar-age rocks) have been identified from the mounds examined, mostly delicate fenestrates, in places accompanied by bifoliate fistuliporoids, and occasionally by tiny rhabdomesids. Two species in particular occur in all (*Exfenestella exigua)* or most (*Banastella regalis*) of the mounds investigated. Several more species are rare but found in many of the mounds, while others are both rare and in few of the bioherms. Sedimentologic or constructional roles envisioned for these bryozoans include possible baffling or trapping mud from suspension, stabilizing or anchoring already-deposited unconsolidated sediment, and probable locally contributing minor skeletal debris to the accumulating carbonate sediment.

These small mud-mounds furnish interesting comparisons and contrasts to other bryoherms, especially Ordovician crust-mounds and Permian frame-thickets

Actualized biological definition of the Bryozoa

Jean-Loup L. d'Hondt

Muséum National d'Histoire Naturelle, USM 0403 « Biodiversité et dynamique des communautés aquatiques », Département «Milieux et peuplements aquatiques», (Biologie des Invertébrés marins), 55, rue de Buffon, F – 75231 Paris Cedex 05.

Reactualized definition of the phylum Bryozoa, after critical discussion of their main biological characters by the light of the more recent knowledges on this taxon :

Colonial animals which are morphologically and anatomically unsegmented, triploblastic, with embryonic endomesoderm and generally abortive endodermic macromeres; endocoelomates without archimery, in the larva as in the adult; two-layered – ectodermic and mesodermic - tegument, each layer with peculiar morphological and ontogenetical capacities, on the one hand in the larva, on the other hand in the adult; with chitinous or chitino-alcareous exoskeleton; embryologically with protostomian larva, but atypical deuterostomian ancestrula - and by the way it is also the case for the other adult individuals, the autozoecia- ; neither hyponeurian nor epineurian in the adult stages; of which some epidermical cell lineages, true stem cells, keep a given and permanent totipotence from the larval metamorphosis to the death of the zoarium, this latter proceeding by clonal development from a single larva; presenting, according to the different phylogenetic trends, various types of ontogenetic capacities of morphogenetical substitutions; of which capacities of epidermic cells are polarized; where each neopolypidial morphogenesis is an automatic biological phenomenon, probably under hormonal influence; devoid of some physiological systems (respiration, circulation, excretion); with adult tentacles from ectodermic origin; ectoprocts; with generally an intermittent digestive system (= main part of the polypid), periodically degenerating and renewed from an epidermic proliferation to the inside (consequently : 1°- the adult epidermis has kept some morphogenetical capacities of a gastrula; 2°- the budding – by disappearing of an inhibition factor – from an ectodermis, of an organ with a digestive vocation, is an infraction to the classical theory of the embryological layers; with digestive system U-shaped, without digestive gland; without coelom in the larva, the coelomic cavity appering by schizocoelie only during the metamorphosis.

Some evolutive trends genetically « programed » and predetermined, materialized by embryological apoptosis and pre-differentiations, events obvious from the embryological stages. Elaborated coloniality (pore plates and funicules-rosettes system); presenting both capacities of asexual and sexual reproduction and a very complicated metamorphosis. The species are mainly sedentary and benthic, exceptionally free-living; always aquatic, generally marine; filter-feedings with prevalent vegetalian diet. Oftern an interzoecial polymorphismm corresponding to a functional specialisation of the individuals.

The Historical collections of Recent Bryozoa in the French National Collections

Jean-Loup L. d'Hondt

Muséum National d'Histoire Naturelle, USM O403 « Biodiversité et dynamique des communautés aquatiques », Département «Milieux et peuplements aquatiques» (Biologie des Invertébrés Marins), 55, rue de Buffon, F – 75231 Paris Cedex 05.

The collections of the Muséum National d'Histoire Naturelle of Paris contain hundreds lots of specimens regarded as precious from a historical point of view, because they have been collected by ancient and prestigious naturalists (as Vaillant, Lamarck, Lamouroux, Péron, Lesueur, Quoy, Gaimard, Henri Milne Edwards or Jullien), and often containing numerous type-specimens from the XVIIIth or XIXth centuries, or arising from famous later circumnavigations (for example, voyages of Baudin, Dumont d'Urville or Freycinet). This historical material is presented here under the names of the authors having collected, offered or valorized the collections.

Bryozoan-sponge associations to bryozoan stable carbonate lithoskels and silica spicules accumulations, to friable limestones with flint layers

Linda Deer & Yvonne Bone

Geosciences, School of Earth & Environmental Sciences, University of Adelaide, Australia, 5005.

The Cretaceous chalk of Europe has long been noted for its extensive stratigraphic-like flint horizons. This phenomenon is also observed in many other limestones throughout the Cenozoic, e.g. the Eocene Wilson Bluff Limestone of South and Western Australia and the Gambier Limestone of Victoria and South Australia. All the limestones have some notable features in common:

- they are invariably friable, indicating minimal carbonate diagenesis,
- they are bryozoan-rich, indicating they were formed in a cool-water or polar environment,
- the majority of the bryozoans present are genera that today use low-Mg calcite (LMC) for their skeletons,
- the majority of these bryozoans today live in deeper water, i.e. below 100m.

These flint layers are not present in all bryozoan-rich limestones. Some may have irregularly-spaced chert nodules, but have not developed spectacular flint horizons. These "limestones" are often more marls than true limestones, and will also often contain partially-silicified sponge body fossils. Yet other bryozoan-rich limestones do not have any such features but these are usually relatively shallow-water mollusc-rich units, with a diverse assemblage of accessory biota.

We proposed that the spicules from siliceous sponges were the source of the silica that forms the flint, not quartz-rich terrigenous input during low-stands or silica-rich groundwaters during diagenesis. Our research looked at the percentage of silica spicules contained in living sponges, on a weight/weight basis. The living sponges were collected from a range of depths from the southern Australian continental margin. The sponge material was frozen upon collection so that no changes would occur prior to laboratory testing. Ascidians were also collected from the same sites, as these also contain spicules, but these silt-sized mace-shaped spicules are aragonitic. Aragonite is metastable and readily dissolves during early diagenesis.

The results showed that there is an increase in spicules in sponges (weight/weight) as the water depth increases. Thus, as the organic fraction of the sponge decays after death, there is a greater source of silica spicules incorporated into the accumulating sediment. These same sediments coincide with those with the higher percentage of bryozoan fragments. Furthermore, these bryozoans belong to genera that use LMC for their skeletal elements. The ascidian spicules show the same depth behaviour.

Silica is metastable in the presence of high pH waters. The ascidian spicules and the minor bryozoans using metastable carbonates for their skeletons would buffer any circulating waters, thus maintaining a high pH, enabling the dissolution of the sponge spicules.

We propose that later in the geological record, the alkalinity of the water changes and the silica precipitates at that horizontal level as a layer of flint. So, the association of living bryozoans and sponges, and ascidians to a lesser degree, has important implications for the rock record.

Environmental impact of the river Nile on the Recent bryozoans of the northern coast of Egypt

Yasser A. El Safori

Department of Geology, Faculty of Science, Ain Shams University, P.O. Box 11566 Cairo, Egypt

Two marine biofacies for the Recent bryozoans of the northern coast of Egypt are recorded. The negative impact of the fresh waters and clastics of the River Nile downstreams is recorded from the coastal sediments of the Delta and to the East (East biofacies). This effect is completely minimized to the West of the Nile Delta (West biofacies) for being far from the Nile downstreams and their lateral water drifts. The coastal sediments of the West biofacies are composed of carbonate grains rich in erect and liberated encrusting bryozoans. Also, encrusting bryozoans grow upon different substrates of molluscan shells, rock fragments, and plant stems. However, encrusting anascans bryozoans of low diversity, characterize the East biofacies. The coastal sediments of the East biofacies are composed of quartz sands with rare/or no erect bryozoans. Also, the encrusting bryozoans are collected from the molluscan shells and wave barriers. Across the downstream straits (brackish waters), only encrusting colonies of *Membranipora lacroixii* are recorded on the wave barriers. The population abundance of the encrusting bryozoans is related to other encrusters as calcareous tubeworms and barnacles.

Oligocene bryozoans From al Jabal Akhdar, Libya

Yasser A. El Safori

Geology Department, Faculty of Science, Ain Shams University, P.O. Box 11566 Cairo, Egypt

Ahmed M. Muftah

Geological Department, Geological Laboratory, Arabian Gulf Oil Company, P.O. Box 263 Benghazi, Libya

Fifteen bryozoan species are separated from the Oligocene sediments (Faidiya Formation) of al Jabal Akhdar, East Libya. They represent one of the minor records of the marine Oligocene bryozoans of North Africa. The studied assemblage are mostly erect cheilostomatous species, associated with reefal fauna of benthic foraminifers and ostracods.

The paleobiogeography of the studied bryozoans indicates their East Atlantic/ Mediterranean affinity. The paleoecology of the studied bryozoans is discussed along with the studied lithofacies.

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Bryozoans from the Artinskian (Lower Permian) Great Bear Cape Formation, Ellesmere Island (Canadian Arctic)

Andrej Ernst

Institut für Geowissenschaften der Christian-Albrechts-Universität zu Kiel, Ludewig-Meyn-Str. 10, D-24118 Kiel, Germany

Hans Arne Nakrem

Geological Museum, University of Oslo, PO Box 1172 Blindern, NO-0318 Oslo, Norway

During the 1898-1902 «Fram» expedition to the Canadian Arctic islands, scientific material was collected and in part described in more than 27 reports. Geological material was collected by P. Schei, and some Upper Palaeozoic bryozoans from the expedition were described by T. Tschernyschew and P. Stepanov in 1916. The current investigation is based on a small collection housed in the Geological Museum (Oslo) from Great Bear Cape, Bjorne Peninsula, SW Ellesmere Island. The stratigraphic unit has for a long time been known as «Unknown Fm.», of uncertain age. Recent fieldwork and conodont investigations by B. Beauchamp and C. M. Henderson have made it possible to revise the stratigraphy here, and the lithostratigraphic unit is now known as the Great Bear Cape Formation of Artinskian-Earliest Kungurian (Early Permian) age. Sedimentation took place on a carbonate shelf under regressive conditions, _ the lithology consists of resistant, yellowish-weathering, pure to locally sandy, variably cherty, highly fossiliferous limestone. Remnants of bryozoans as well as other animals reveal numerous borings by unknown organisms. The bryozoan fauna comprise the following taxa: Cystoporida: *Fistulipora volongensis* Nikiforova 1938, *Fistulipora* sp., *Cyclotrypa distincta* Morozova 1986, *Ramiporidra variolata* Shul'ga-Nesterenko 1933. Trepostomida: *Hinaclema* sp., *Tabulipora* spp., *Rhombotrypella* ? *amdrupensis* Ross & Ross 1962, *Dyscritella vulgata* Gorjunova 1972, *Dyscritella tenuis* Kruchinina 1973. *Ulrychotrypa ramulosa* Bassler 1929. Cryptostomida: *Streblascopora vera* Morozova 1986, *Streblascopora germana* (Bassler 1929), *Clausotrypa monticola* (Eichwald 1860), *Primorella ? superba* Morozova 1981, *Primorella tundrica* Kruchinina 1986, ?*Rhombopora* sp., *Bashkirella operculata* Shul'ga-Nesterenko 1952. Cryptostomida (Intraporidae): *Phragmophera* sp. n. Fenestrida: *Alternifenestella bifida* (Eichwald 1860), *Alternifenestella crassiseptata* (Shul'ga-Nesterenko 1941), *Alternifenestella cyclotriangulata* (Eichwald 1860), *Alternifenestella* cf. *invisitata* Kruchinina 1986, *Fabifenestella* cf. *subvirgosa* (Shul'ga-Nesterenko 1952), *Fabifenestella* cf. *virgosa* (Eichwald 1860), *Fabifenestella tortuosa* (Trizna & Klautsan 1961), *Fenestella akselensis* Nakrem 1995 [1994], *Rectifenestella microporata* (Shul'ga-Nesterenko 1939), *Rectifenestella robusta* (Shul'ga-Nesterenko 1936), *Polypora confirmata* Kruchinina 1986, *Polypora kossjensis* Ravikovich 1948, *Polypora kutorgae* Stuckenberg 1895, *Polypora martis* Fischer 1837, *Polypora voluminosa* Trizna & Klautsan 1961, *Penniretepora invisa* (Trizna 1939), *Acanthocladia* cf. *sparsifurcata* Shul'ga-Nesterenko 1939, *Acanthocladia* cf. *rhombicellata* Shul'ga-Nesterenko 1955.

Beside these taxa, two more bryozoans are problematical in their taxonomic assignment belonging apparently to trepostomes and cryptostomes respectively. *Phragmophera* sp. n. is until now the youngest known representative of bifoliate cryptostomes.

The taxonomic composition bears a striking similarity with Sakmarian-Artinskian faunas known from Timan-Pechora area (Western Siberia, Russia) and the Artinskian-Kungurian of Svalbard, the Early Permian of NW Greenland, as well as some Early Permian faunas previously described from Ellesmere Island.

Lower Carboniferous Bryozoa from some localities in Sauerland (Germany)

Andrej Ernst

Institut für Geowissenschaften der Christian-Albrechts-Universität zu Kiel, Ludewig-Meyn-Str. 10, D-24118 Kiel, Germany

Lower Carboniferous bryozoans from Germany are scarcely investigated because of their mostly poor preservation. Only few papers were published about this fauna, with restricted use of oriented thin sections. The most extensive study has been performed by Nekhoroshev (1932). However, some newly investigated localities in Sauerland (Westenfeld, Hellefeld, and Frenkhausen) revealed a number of bryozoans in excellent, mostly calcitic preservation. Material was sampled by Dieter Weyer and Dieter Korn (both Berlin) from rocks dated by *Goniatites crenistria* and *Arnsbergites gracilis* zones of the Lower Carboniferous. Lithology is characterized by turbidid sediments, bearing numerous organic remnants (bryozoans, brachiopods, calcareous algae etc.).

About 50 thin sections were prepared from the available material. Following bryozoan taxa could be identified during the present investigation: *Fistulipora incrustans* (Phillips 1836), *Evactinopora* sp., *Stenopora* sp., *Nipponostenopora* ? sp., *Stenodiscus redesdalensis* (Lee 1912) (= *S. tumida*; Wyse-Jakson, pers. comm.), *Rhabdomeson progracile* Wyse Jackson & Bancroft 1995, *Rhabdomeson regulare* Nekhoroshev 1932, *Nematopora hibernica* Wyse-Jackson 1996, *Streblotrypa pectinata* Owen 1966, *Rhombocladia* cf. *dichotoma* (M´Coy 1844). The rock contains also numerous unidentified remnants of fenestellid bryozoans.

The faunal composition shows a close relation to the Lower Carboniferous of the British Isles. This is the first record of the genus *Evactinopora* Meek & Worthen 1865 from the Lower Carboniferous of Europe. The genus *Evactinopora* is a typical fossil of the Lower Carboniferous of Northern America and Western Australia. Elsewhere it was reported from the Middle Carboniferous of SE Russia (Morozova 1981). The species *Rhabdomeson regulare* Nekhoroshev 1932 was also reported from the Lower Carboniferous of Russia (Morozova 1955)

Paleobiogeography of Middle to Late Permian Bryozoans

Ernest H. Gilmour

Department of Geology, Eastern Washington University, Cheney, WA, 99004, USA

Iraida P. Morozova

Paleontological Institute, Russian Academy of Sciences, Profsoyuznaya ul. 123, Moscow, 117647, Russia

Middle to Late Permian bryozoans, which belong to 119 genera, 29 families, and 7 orders, lived in all climatic zones. These bryozoan genera occur in 19 provinces of 6 regions. New unpublished data from New Zealand, Pakistan, Cordilleran of western U.S., and Texas are included in this summary. The majority of bryozoan genera in the Permian are cosmopolitan, but several are confined to boreal, tropical, or notal climatic zones. Some genera normally found only in the Euro-Canadian boreal zone occur in the Cordilleran province; whereas the bryozoan fauna of the New Zealand province includes both notal endemic genera as well as genera that are in common with or very close to bryozoans of the boreal province. These genera represent a bipolarity in the evolution of cold-water faunas during the Middle to Late Permian.

The peak of taxonomic diversity occurred in the Wordian (Early Kazanian) with a considerable number of highly specialized genera emerging and then becoming extinct by the end of the Capitanian (Late Kazanian). Extinction of genera continued during the Wuchiapingian and Changhsingian Stages with only four genera of bryozoans (trepostomes) surviving into the Triassic. This gradual reduction of bryozoan genera during the Middle and Late Permian and the survival of at least four genera into the Triassic does not support a sudden extinction event at the end of the Changhsingian for this group of organisms.

The cheilostomatous genera of Alcide d'Orbigny – nomenclatural and taxonomic status

Dennis P. Gordon

National Institute of Water Atmospheric Research, P.O. Box 14-901 Kilbirne, Wellington, New Zealand

Paul D. Taylor

Department of Palaeontology, The Natural History Museum, Cromwell Road, London SW7 5BD, U.K.

Alcide Dessalines d'Orbigny was the author of 75 genera of Cheilostomata, 73 of which were introduced in his volume on Bryozoa in the *Paléontologie française* series *Terrains crétacés*. A recent SEM study of as many type and other specimens pertaining to these genera has made possible the clarification of the nomenclatural and taxonomic status of the genera. Discarding those genera for which type species and specimens are lost and which may never be properly understood, we regard 40 as having validity. These include 16 previously overlooked or ignored in Bassler's (1953) *Treatise* revision, viz *Filiflustrina*, *Latereschara*, *Lateroflustrella*, *Multescharellina*, *Multescharipora*, *Pyriflustrina*, *Reptescharella*, *Reptoflustrella*, *Reptolunulites*, *Reptoporella*, *Reptoporina*, *Reptescharinella*, *Semiescharipora*, *Semiflustrella*, *Semiflustrina*, and *Reptescharipora*.

These genera are reinstated, based on identifiable type species. We give new diagnoses for each of these genera and classify them to family level according to current phylogenetic concepts of the order.

A new genus of Umbonulidae (Bryozoa: Cheilostomata) from the northwest Pacific

Andrei V. Grischenko & Shunsuke F. Mawatari

Laboratory of Systematics and Evolution, Division of Biological Sciences, Graduate School of Science, Hokkaido University, Sapporo 060–0810, Japan

A new genus and species of Umbonulidae is described from two areas of the northwestern Pacific: Ptichii Island (Western Kamchatka shelf of the Sea of Okhotsk) and Bering Island (Commander Islands, the Bering Sea). The colony is encrusting. Zooids are umbonuloid with a solid umbo and the secondary orifice is cormidial. There are no suboral avicularia, ovicells or oral spines. The new genus is close to *Umbonula* in having an umbonate frontal shield with marginal areolae separated by elongated ridges; however the new species differs from *U. ovicellata* Hastings, 1944 (the type species of *Umbonula*) in the cormidial nature of the secondary orifice and the absence of a suboral avicularium and ovicells. Discovery of the new genus and species justifies splitting the genus *Umbonula* Hincks, 1880. In a newly suggested classification, each segregated genus includes several species, avoiding monotypy. Accordingly, *U. littoralis* Hastings, 1944 and *U. inarmata* Kluge, 1962, together with the newly described species, are included in the new genus. The nominate genus is here taken to include *U. patens* (Smitt, 1868), an undescribed species from the Commander Islands as well as the type species. Whereas *Arctonula* Gordon & Grischenko, 1994 was segregated from *Umbonula* and removed to the Romanchindae, the new genus is accepted as a member of the family Umbonulidae even though it lacks ovicells. The new taxon occurs predominantly intertidally but ranges to 25 m, on hard substrata, and can be categorized as a Pacific high-boreal species.

Diversity, evolution and paleoecology of the Tertiary bryozoan assemblages of western Kachchh, Gujarat, India

Asit K. Guha & K. Gopikrishna

Department of Geology & Geophysics, Indian Institute of Technology, Kharagpur-721 302, India.[Email: aguha@gg.iitkgp.ernet.in]

Ninety-nine bryozoan species (eight cyclostomatids under six genera and five families, and 91 cheilostomatids under 56 genera and 33 families) have been retrieved from rock formations belonging to the Lutetian – Burdigalian sequences of western Kachchh, Gujarat. Cyclostomatids are restricted to the lower part of Lutetian sequence (Harudi Formation). Only 24 percent of genera have more than one species under them. Among cheilostomatids, the ascophorans are more diverse at different hierarchical levels than the anascans. The present information on number of the Tertiary bryozoan species from Kachchh has considerably enlarged the old checklist of nine fossil species reported from this area about four decades ago. The diversity and richness of bryozoan colonies are highly variable within and between formations, reaching their maximum during the deposition of the Khari Nadi Formation (Aquitanian).

Fifteen fossil species of *Thalamoporella* Hincks, 1887, recognized in these sequences, have doubled the number of fossil taxa under this genus from fifteen to thirty, and have enriched our knowledge about the Tertiary evolutionary history of this common extant genus of tropical and warm temperate waters. The presence of three steginoporellid genera in these formations, out of a total of five Tertiary genera under the family, makes Kachchh one of the main centers of radiation in the spatial evolution of this family. The species under *Therenia* David & Pouyet, 1978, till unknown in the Indo-Pacific realm, may take a conspicuous place in the phylogeny of the genus.

The Tertiary basin of Kachchh, being a pericratonic rift basin located at the western margin of India, was generally shallow with shell banks of various magnitudes and argillites that supported bryozoan colonies associated with shells of foraminifera, bivalves (chiefly oysters), algae, gastropods and barnacles. Encrusters (both uni- and bilaminar) placed under 65 species and represented by over 61 percent of colonies examined, are far in excess of sum total of colonies under other six types of growth habits, namely, erect-rigid-foliaceous, erect-rigid-delicate, free-living, erect-foliaceous, erect-rigid-fenestrate and erect-rigid-robust. An analysis of paleoenvironmental significance of relative abundance of growth habits in different formations has been made.

Bryozoan fauna of Green Island, Taiwan-six new species for science

Tea Gluhak

Rudjer Boskovic Institute, Center for Marine Research, G. Paliaga 5, 52210 Rovinj Croatia

Peter J. Hayward

School of Biologica Sciences, University of Wales, Swansea, Singleton Park, Swansea SA2 8PP

Ivan Cvitkovic

Institute of Oceanography and Fisheries, Laboratory for benthos, Setaliste Ivana Mestrovica 63, 21000 Split, Croatia

Jane E. Lewis

PO Box 7-18, Keelung, Taiwan

Aleksandar Popijac

Laboratory for Animal Ecology, Department of Zoology, Faculty of Science, University of Zagreb, Rooseveltov trg 6, 10000 Zagreb, Croatia

This poster reports on 6 species from Green Island, Taiwan. These are result of two workshops that processed and identified collections from a five day field trip to Green Island, southeast Taiwan. The annotated list presented here includes *Amastigia tricervicornis*, *Caberea sinensis*, *Catenicella marceli, Hemismittoidea taiwanensis*, *Parasmittina spiculata*, *Celleporina avicularidentata* which are reported for science for the first time. The primary objective of this study is to document the distribution of species, and to describe morphological features by which they have been proclaimed as new for science.

Hierarchical sources of environmental variation in a modern bryozoan, *Electra pilosa*

Steven J. Hageman

Department of Geology, Appalachian State University, Boone, North Carolina, 28608, USA

Christopher D. Todd

Gatty Marine Laboratory, School of Environmental andEvolutionary Biology, University of St. Andrews, St. Andrews, Fife KY16 >8LB, Scotland, UK

Documentation of genetic versus environmental sources of morphological variation in skeletal hard parts is important for meaningful application of species concepts to broader studies of paleobiology. This study evaluates the hierarchical influence of large and small scale environmental variation on skeletal morphology of the anascan bryozoan *Electra pilosa* from western Scotland. Previous studies by the authors have established the degree to which morphological variation is induced by genetic variation among closely relatedcolonies in controlled environmental conditions. The data set generated for the present study consists of colonies of *E. pilosa* collected from a 1.5 km region of Clachen Seil Sound, western Scotland at three Stations (~0.5 km apart), from three Substation within each station (10 m apart), five colonies per substation on separate fronds of brown algae (*Laminaria*), and two patches of multiple zooids sampled from each colony. A suite of five morphometric characters was collected from each and analyzed with Nested ANOVA and Principal Components Analysis. Comparable data sets were included in a second phase of analyses using colonies from varied environments along the western coast of Scotland, and colonies grown under invarient environmental condition in the laboratory. Preliminary results indicate that there is : (1) no systematic variation among the three primary stations at Clachen Seil Sound, (2) no systematic variation among the three Substations within each station, (3) variation among colonies within substations is significant for all characters, accounting for 20-35% of the total variance for most characters and 48.5% for the character Zooecia Length. (4) Zooecia Length is most significant among colonies, but less significant than all other characters within colonies. Thus, there is difference between genetic and microenvironmental (within vs. among colony) effects on length vs. width in zooecial characters, but little systematic effect on any at the meso-enviornmental level of 10 to 500 m of separation.

Miocene free-living bryozoans from Patagonia

Eckart Håkansson,

Geological Institute, University of Copenhagen

Silvio Casadío & Ana Parras

Departamento de Ciencias Naturales, Universidad Nacional de La Pampa

Cupuladriids are reported for the first time from Patagonia, southernmost South America, where at least two species – *Cupuladria* sp. and *Discoporella* sp. – have been collected from upper Miocene strata.

Miocene deposits in Patagonia, southern Argentina, constitute a comparatively thin sedimentary wedge deposited in an epicratonic basin related to the passive continental margin bordering the Atlantic Ocean. These deposits include a series of spectacular mollusk-bryozoan-dominated shell concentrations comprising the Puerto Madryn Formation. Well-developed exposures of this unit are located around Puerto Pirámides, Península de Valdés. Here the preserved section shows a vertical succession of facies passing from open mid-shelf to more shallow, shoreface to foreshore environments characterized by upward-coarsening cycles capped by condensed shell-beds. Whereas bryozoans in general are plentiful throughout the entire section, the free-living bryozoans appear to be restricted to a number of distinct horizons through the middle part of the formation, where they occur in fair amounts in fine sands with minor mud content.

The biogeographic and phylogenetic implications of the new find will be discussed.

Biogeography and phylogeny of the free-living bryozoans in the Miocene of South America

Eckart Håkansson

Geological Institute, University of Copenhagen

Silvio Casadío

Departamento de Ciencias Naturales, Universidad Nacional de La Pampa

Sven Nielsen

Geologisch-Paläontologisches Institut und Museum, Universität Hamburg

The first finds of cupuladriids from Patagonia, southernmost South America, have provoked speculations as to the mode and tempo of the Neogene invasion of free-living bryozoans into South America.

Two routes were utilized from a Caribbean center of evolution prior to the closure of the Isthmus of Panama, one along the east coast and one along the west coast. Migration along the east coast reached as far south as Península de Valdés in Patagonia whereas, on the west coast, the southernmost occurrence is around Navidad in central Chile. While the Atlantic trail apparently was utilized solely by cupuladriids – with both *Cupuladria* sp. and *Discoporella* sp. reaching all the way to Patagonia – the Pacific trail may also have provided a sanctuary for the last surviving members of the North American branch of the Otionellidae.

Bryozoans from Zechstein (Upper Permian) of southwestern Poland

Urszula Hara

Polish Geologiccal Institute Rakowiecka, 4 00-975 Warsaw, Poland

The rich and diverse Permian bryozoan fauna from the southwestern part of Poland has proved to be significant in respect of taxonomy and biogeographical connections. The bryozoans come from the marly calcareous series of the Lower Zechstein of the North Sudetic Basin accompanied by a rich shallow water biota (Raczy_ski 1996). In terms of the higher taxa the Zechstein bryozoans are dominated respectively by fenestriids which form a lyre-shaped colonies, however, the trepostomids also constitue an important epibiontic element of the studied fauna. The following fourteen taxa have been distinguished in the systematic account, making extensive use of SEM: *Stenopora columnaris* (Lonsdale), *Rectifenestella retiformis* (Schlotheim), *Fenestella geinitzi* (d'Orbigny), *Fenestella minuta* Korn, *Fenestella* sp., *Penniretepora* sp., *Thamniscus diffusus* Korn, *Thamniscus geometricus* Korn, *Thamniscus siccus* Dreyer, *Thamniscus* sp., *Kingopora solida* (Korn), *Acanthocladia anceps* (Schlotheim), *Acanthocladia minor* Korn, *Acanthocladia laxa* Korn (see Hara 2001). The species of *Fenestella* sp., *Penniretepora* sp., *Thamniscus siccus* Dreyer, *Thamniscus* sp and *Kingopora solida* (Korn) are the first time recorded from Poland. *Thamniscus* sp. and *Penniretepora* sp. should to be referred to the type material, because they may represent the new taxa . The relationship between the colony-form, growth pattern, inferred associated biota as well as sedimentary structures points to shallow-water environment with low to moderate current activity for Zechstein palaeoenvironment of the North Sudetic Basin.

This recently studied fauna adds to the knowledge of the Permian taxonomy some important facts which previously was based on the fragmentary data what reduces its biogeographical value. From the zoogeographical point of view, the Polish Permian bryozoans accentuates the biostratigraphical links and a marked faunal affinity with the bryozoans of the West-European province of England and Germany as well as with the southern Baltic Region. This fauna shows a great importance of fenestellids and acanthocladiids during the Zechstein giving priority of such taxa as *Rectifenestella, Penniretepora, Thamniscus, Kingopora* and *Acanthocladia* (Korn 1930, Gilmour 1999).

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Morphological description of the setae of four species of the family Cupuladriidae from both sides of the Isthmus of Panama

Amalia Herrera-Cubilla & Felix Rodriguez

Center for Tropical Paleoecology and Archaeology, Smithsonian Tropical Research Institute P.O. Box 2072, Balboa/ Ancon Panama Rep. of Panama

In this work we describe the morphology of the setae or mandibles of four species of the family Cupuladriidae. Three of them are from the Caribbean: *Cupuladria biporosa* Canu and Basller 1923, *Cupuladria surinamensis* Cadée 1975, and *Discoporella* 2. While one is from the Pacific: Cupuladria 5 biporosa.

C. biporosa and Cupuladria 5 biporosa have three kind of seta or mandibles. While *C. surinamensis* and *Discoporella* 2 presented only one type of seta. The morphology of the seta varies greatly between species and gives valuable information, which could help for a better taxonomical understanding of this family and probably its live history.

Taxonomy of the genus *Cupuladria* from both sides of the Isthmus of Panama. I. Morphology and Systematics

Amalia Herrera-Cubilla

Center for Tropical Paleoecology and Archaeology, Smithsonian Tropical Research Institute P.O. Box 2072, Balboa/ Ancon Panama Rep. of Panama

Matthew H. Dick

Department of Biology, Middlebury College Middlebury, VT 05753 USA

JoAnn Sanner

Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia 20650

Jeremy B.C. Jackson

Center for Tropical Paleoecology and Archaeology, Smithsonian Tropical Research Institute P.O. Box 2072, Balboa/ Ancon Panama Rep. of Panama

Geoscience Research Division, Scripps Institution of Oceanography, La Jolla, California 92093

Up to 28 morphological characters were used to analyze phenetically colony specimens of the genus *Cupuladria* collected from both coast of the Isthmus of Panama. These characters were used first to Cluster colonies and obtain discrete groups that were later entered in a series of Direct Discriminant Analyses that permitted us to identify morphospecies with high confidence. The taxonomy, so obtained, showed a clear cut off between specimens of the *C. surinamensis* clade vs. *C. biporosa* clade, as has been pointed out in the phylogeny of the genus *Cupuladria*. Also revealed a greater morphospecies diversity, from both sides of the Isthmus of Panama, than that documented in the literature, and demonstrated no evidence of the presence of *C. canariensis* in this part of Tropical America. Despite that more rigorous phenetical analyses still to do, this first attempt prove that morphometric analyses of cheilostomes should be pushed to their limit, to obtain meaningful taxonomies of particularly difficult groups like *Cupuladria*.

Bol. Soc. Biol.Concepción, Chile. Tomo 74, 2003

Taxonomy of the genus *Cupuladria* from both sides of the Isthmus of Panama. II. Description of the species

Amalia Herrera-Cubilla

Center for Tropical Paleoecology and Archaeology, Smithsonian Tropical Research Institute P.O. Box 2072, Balboa/ Ancon Panama Rep. of Panama

JoAnn Sanner

Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, District of Columbia 20650

Matthew H. Dick

Department of Biology, Middlebury College Middlebury, VT 05753 USA

Jeremy B.C. Jackson

Center for Tropical Paleoecology and Archaeology, Smithsonian Tropical Research Institute P.O. Box 2072, Balboa/ Ancon Panama Rep. of Panama

Geoscience Research Division, Scripps Institution of Oceanography, La Jolla, California 92093

The identification of eight species of the genus *Cupuladria* collected from both sides of the Isthmus of Panama was done using up to 28 morphological characters entered in a rigorous phenetic analyses described in a previous paper. Six species *Cupuladria multesima*, *Cupuladria incognita*, *Cupuladria cheethami*, *Cupuladria pacifiensis*, *Cupuladria exfragminis* and *Cupuladria panemensis* are described as new. Two species *Cupuladria biporosa* and *Cupuladria surinamensis* have a wider distribution in the Caribbean. This morphological description provides further documentation of the greater morphospecies diversity, of the genus *Cupuladria* from both sides of the Isthmus.

A novel technique for the assessment of the distribution of *Lophopus crystallinus*, a rare phylactolaemate within the U.K.

Samantha Hill

School of Animal and Microbial Sciences, University of Reading, PO Box 228, Reading, RG6 6AJ, United Kingdom

Beth Okamura

School of Animal and Microbial Sciences, University of Reading, PO Box 228, Reading, RG6 6AJ, United Kingdom

At the Rio Earth Summit in 1992, the delegates ratified the Convention of Biological Diversity which committed the nations to the maintenance of biological diversity. This agreement led the U.K. to generate the Biodiversity Action Plan (B.A.P.) in 1994. The U.K. B.A.P. consists of Habitat Action Plans (H.A.P.) and Species Action Plans (S.A.P.). The H.A.P.'s and the S.A.P.'s respectively outline the current status and necessary management to ensure the continuation of threatened habitats and species within the U.K. *Lophopus crystallinus* is the only bryozoan listed within the U.K. B.A.P. and it is given a classification of 'RARE'. The objectives of the S.A.P. for *L. crystallinus* include the maintenance of all long-term populations in the U.K., and to increase the number of populations within the U.K. by 2010. The protection of sites with known populations is also discussed, as is the possibility of designating these sites as Sites of Special Scientific Interest (SSSI), which may help to safeguard the populations. The Invertebrate Site Register of *L. crystallinus* by English Nature lists 10 sites within England, but *L. crystallinus* has only been observed at four of these sites since the 1970's. O'Dea (unpublished report) surveyed various sites throughout the U.K. in 2001/2002 and found evidence of populations in only two sites. We have developed a technique to quickly ascertain the presence of *L. crystallinus* within a watershed by the inspection of flood or floating debris for *L. crystallinus'* floatoblasts. Flood debris gathers on banks after high waters and is normally composed of fine-grained organic detritus. Floating debris gathers in slow moving areas of lakes and rivers and can be composed of any floating material; often twigs, leaves, seeds, and grass are picked up along with statoblasts. We describe techniques to sample flood and floating debris for *L. crystallinus* statoblasts and present results of collections from over 50 sites. This approach has allowed us to confirm the presence of *L. crystallinus* in river systems from which it has previously not been recorded, and leads to the conclusion that its distribution is much more widespread than formerly thought. This work may have an impact upon the Rare status given to *L. crystallinus* within the U.K. Red Data Book and will certainly have an impact upon the S.A.P. of *L. Crystallinus*.

Bol. Soc. Biol.Concepción, Chile. Tomo 74, 2003

A review of the effects of heavy metal toxicity in freshwater Bryozoa

Victoria B. Holmes

Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

Mary E. Spencer Jones

Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

Work on the effects of heavy metal contamination in fresh water Bryozoa has been very limited with the main bulk of investigations carried out in the 1980's. The studies carried out have concentrated on the mortality rates of the Bryozoa, with very little work carried out on the effects of the heavy metals on the internal structure of the organism or the statoblasts produced. Early work has mainly hinted at the possible effects of specific heavy metals on the structure of statoblasts with no continuation of the study. This review is an attempt to access the work carried out so far and to look at the areas that have not been covered in the experimental work carried out.

Phylogeography and Sibling Speciation in *Celleporella hyalina*

Roger N. Hughes, A. Gómez, P. J. Wright, D. Lunt, & G.R. Carvalho,

School of Biological Sciences, University of Wales, Bangor, Gwynedd, LL57 2UW, UK.

Juan M. Cancino

Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción, Casilla 297, Concepción, Chile

Hugo I. Moyano G.

Departamento de Zoología , Universidad de Concepción; Casilla 160-C; Concepción. hmoyano@udec.cl

Celleporella hyalina is reported from cold-temperate to polar oceans circum-globally. We have sampled populations from around the world and investigated the genetic diversity, at both mitochondrial and nuclear loci, found in this 'cosmopolitan' species. Laboratory mating studies to determine mating compatability have accompanied this molecular approach.

Both mtDNA and nuclear gene sequences strongly support *C. hyalina* as a sibling species complex. Mating compatibility trials indicate that some 11 major lineages are reproductively isolated. These lineages are not recent but represent millions of years of independent evolution, perhaps since the Miocene (~10myrs). Phylogeographic substructure is evident within each of these major lineages. The NE Atlantic contains several geographically structured lineages which are probably of Pleistocene or Pliocene origin.

The C. *hyalina* species complex seems to have originated in the northern hemisphere, possibly in the N Atlantic, with at least two episodes of colonization of the Pacific predating the opening of the Bering Strait. At least three more recent long-distance colonization events were revealed. Two of these events are trans-tropical, involving colonization of the South Pacific by northern clades, one from the north Pacific to Chile and Argentina and other from the North Atlantic to the Magellanic region. A third event involved the recent colonization of Svalbard by genotypes from coastal Alaska.

Discussions on the benefit of commensalism in solitary entoprocts (Entoprocta: Loxosomatidae)

Tohru Iseto

The Kyoto University Museum, Kyoto University, Yoshida, Sakyo, Kyoto 606-8501, Japan.

Entoprocts are suspension feeders that create water currents using tentacular cilia and catch food particles in the currents. Most of the solitary entoprocts (=loxosomatids) are known to live on bodies or tubes of other animals such as polychaetes, bryozoans, sponges, and sipunculans. The commensal species has been believed to be "energy commensals" that partly depend on host-made currents to get enough foods. In fact, some species have very short tentacles that seem to be incapable of creating sufficient water currents by themselves.

Recently, ten non-commensal loxosomatids were described from Okinawa, Japan. The ten species live on non-living substrata and get foods through self-made water current only. However, there is no considerable difference in number and length of tentacles between commensal and non-commensal species. It suggests that most commensal species, except some short-tentacle species mentioned above, are also able to make sufficient water currents by themselves and not depend largely on the host-made currents.

My observations on non-commensal species found in Okinawa, Japan suggest other benefits in their commensalism. Several times, I observed non-commensal species covered by bryozoans. Such coverage by other organisms is obviously fatal for entoprocts. The non-commensal species in Okinawa tend to settle on «naked» substrate that is less covered by other organisms: this may be to avoid covering by neighboring animals. On the other hand, some benthic animals such as nudibranches and flat worms are known to eat entoprocts. The tubes of host animals or protection mechanism of host animals may keep the predators away from loxosomatids.

These observations and speculations suggest that the major benefit of commensalism in loxosomatids is avoiding coverage and predation by other animals. The host bodies or tubes seem to be very safety habitat for them.

Bryozoans and Bryozoa-associated fungi from Galápagos Deep Sea

Jürgen Kaselowsky & Joachim Scholz

Research Institute Senckenberg, Section ME III, Frankfurt am Main, Germany.

The major objective of the 1999 cruise of the R/V SONNE (SO 144-3) was the systematic sampling of volcanic rocks in the area between the Galápagos Islands and Central South America. In 2001, the R/V SONNE cruise 158 (SO 158) was the systematic sampling of rocks from submarine volcanoes ("seamounts") and an east-west trending volcanic ridge, the so-called Galápagos spreading center, located north of the Galápagos archipelago. Both cruises have documented a highly diverse bryozoan fauna, collected by P. Götz. B. Neuhaus and C. Lüter (Berlin). There are about 50 species, many of them new and belonging e.g. to *Catenicella*, *Chaperiopsis*, *Escharina*, *Notoplites*, *Pleurocodonellina*, and *Talivittaticella*. Furthermore, a strange interior walled cyclostome species was found that represents at least a new genus.

In a colony *Columnella* cf. *graminea* collected from a depth of 1558 m, the frontal membrane is colonized by hyphae and yeast cells of fungi. This is one of the very first reports of fungi from the deep sea (see Kaselowsky et al 2003).

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Comparison of selected ascophorine bryozoans from Red Sea, Philippines, and Socotra (Yemen)

Jürgen Kaselowsky

Research Institute Senckenberg, Section ME III, Frankfurt am Main, Germany.

Ever since HARMERS Siboga Reports, type material from the Red Sea (e.g. WATERS) has been used to identify bryozoans from the tropical western Pacific. On the other hand, in their monography of Smittinids of Hawaii, SOULE & SOULE (1973) have demonstrated that bryozoans show a distinct regionalism (as marine "Darwin Finches"). A re-evaluation of types from some Indo-Pacific collections (*e.g.* WATERS, Red Sea, DOEDERLEIN / ORTMANN, Japan), and modern state-of-the-art re-illustration of type material has now become necessary to have a new data base about the comparative morphology of indopacific bryozoans.

Some selected ones, which are known for extraordinary wid-ranging distribution patterns, should be revised. Comparison of type material with colonies from the Philippines, Japan and New Zealand, which have been collected within the scope of earlier research grants projects (HI 273/3, 446; SCHO 581/6; JAP-113/216/0; GE 64/8) helps to outline the true geographical range of several circumtropical or indopacific species.

One holotype which was re-examined was *Smittia tropica* = *Parasmittina tropica*. The type-material from the HARTMEYER collection was described by WATERS (1909). Parts of the holotype stored at the Humboldt-Museum of Natural History in Berlin have been bleached and prepared for SEM. Comparison of *P. tropica* specimen from New Zealand described by GORDON (1984), *P. tropica* from Mauritius reported by HAYWARD (1988), and colonies determined by SCHOLZ (1991) from the Philippines revealed, that these are different species. In the collection of H. RISTEDT (Bonn) which is now kept at the Senckenberg-Museum, additional new *Parasmittina* species similar to *P. tropica* are documented.

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C and O isotopic test of the algal symbiosis hypothesis for gigantism in Permian Trepostomes from Greenland

Marcus M. Key, Jr.

Department of Geology, Dickinson College, Carlisle, PA 17013-2896, U.S.A.

Patrick N. Wyse Jackson

Department of Geology, Trinity College, Dublin 2, Ireland

Eckart Håkansson

Institute of Geology, Øster Voldgade 10, DK-1350 København, Denmark

William P. Patterson

Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, SK S7N 5E2, Canada

M. Dustin Moore

Department of Geology, Dickinson College, Carlisle, PA 17013-2896, USA

Gigantism in organisms can be caused in various ways: by disease, under ideal growing conditions, or symbiosis. It is well documented that symbiotic zooxanthellae algae can cause gigantism in Recent hermatypic corals. However, such symbiotic relationships have never been documented for extant or fossil bryozoans. Unusually large colonies of the trepostome bryozoan *Tabulipora* sp. have been recovered from the Kungurian (Early Permian) Kim Fjelde Fm. in eastern North Greenland. Branches reach 7 cm in diameter in this species, while other bryozoans in general and other *Tabulipora* species in particular in the fauna are an order of magnitude smaller. Disease can be ruled out as a causal factor for this example of gigantism, as all individuals in the species exhibited gigantism. Ideal growing conditions can not be completely ruled out as not all other species in the fauna exhibited normal growth sizes. Håkansson and Madsen (1991) hypothesized that the gigantism was caused by algal symbiosis. Their conclusion was based on carbon and oxygen isotopic values derived from coarse sampling that required ≥ 1.5 mg carbonate.

In this study using a colony from the same formation and location, a more precise test of their hypothesis was conducted by sampling with 10 μm spatial precision using a computer-driven micromilling device that required only ≥ 20 μg carbonate. Skeletal results indicate a mean _^{13}C value of 3.85 ‰VPDB and a mean _^{18}O value of -6.52 ‰VPDB. Diagenetic effects were evaluated by separately sampling the cements contained within zooecial chambers; skeletal values are significantly heavier than the surrounding cements. Taking into account the inferred isotopic composition of the Permian ocean, it is concluded that these isotopic results fail to reject the algal symbiosis hypothesis for gigantism in these bryozoans. Other potential supporting information is lacking or ambiguous. Other than size and the isotopic signature, the remaining morphologic and paleoenvironmental evidence is equivocal. For example, marine organisms with symbiotic algae typically are restricted to simple phyla, have thin tissue layers, filter feeder, grow toward light, have high surface area-to-volume ratios, high skeleton-to-body ratios, and high levels of colonial integration. They are most common in tropical, oligotrophic, shallow water, low turbidity, reef environments. The giant *Tabulipora* colonies from the Permian of Greenland do not meet most of these criteria.

Bol. Soc. Biol.Concepción, Chile. Tomo 74, 2003

From Plate tectonics to bryozoan evolution

Marcus M. Key, Jr.

Department of Geology, Dickinson College, Carlisle, PA 17013-2896, U.S.A.

Abigail M. Smith

Department of Marine Science, University of Otago, P. O. Box 56, Dunedin, New Zealand

The hypotheses of biologists, paleobiologists, ecologists and paleoecologists often focus on biotic interactions as they can play important roles in evolution. Often less obvious are abiotic evolutionary forcing mechanisms, particularly large-scale global geochemical cycles. Stanley and Hardie (1998) synthesized a theory of secular geochemical variation over the Phanerozoic, describing oscillations in the mineralogy of marine inorganic and biogenic carbonates, with periods dominated by aragonite/high-Mg calcite (aragonite seas) and low-Mg calcite (calcite seas). They argued that temporal variations in the Mg/Ca ratio of sea water were driven by changes in plate tectonic spreading rates at mid-ocean ridges. Their supporting data included marine cements, ooids, evaporites, and tropical hypercalcifying organisms (*e.g.*, calcareous algae, forams, corals).

If seawater chemistry changes are global in scope, then geochemical signals should be expressed beyond these dominantly tropical examples. Temperate bryozoans, with their wide mineralogical and stratigraphic ranges, offer the opportunity to ascertain the extent of the mineralogical influence of sea water on biogenic carbonate production.

Here we report on the results of a literature review of bryozoan mineralogy over the Phanerozoic. Do bryozoans exhibit more aragonite/high-Mg calcite skeletons during times of aragonite seas and more low-Mg calcite skeletons during times of calcite seas? Do bryozoans have the potential to delineate and refine this global model? And has bryozoan evolution itself been constrained by sea water chemistry?

Bryozoans from the Jade bight in Northwestern Germany and molecular biological analysis of their associated bacteria

Sandra Kittelmann

Institute for Chemistry and Biology of the Marine Environment (ICBM), Environmental Biochemistry, Carl-von-Ossietzky University of Oldenburg, P.O. Box 2503, 26111 Oldenburg, Germany.

The Jade is an extended tidal polyhaline basin on the northwestern coast of Germany. The river Weser provides continuous freshwater supply. At high tide, the Jade covers an area of approximately 160 square kilometres.

Preliminary screens of the site have shown the dominant occurence of the anascan species *Conopeum reticulum*, *Conopeum seurati*, *Electra pilosa* and *Electra monostachys*. These species predominantly occur on native mussel shells and will be collected by dredging.

Based on previous research it is known that both the surface and the coelomic cavity of bryozoa may provide an ideal habitat for specific phylogenetic groups of bacteria depending on metabolism and texture of the host organism (Davidson *et al.* 2001, Gerdes *et al.*,in prep). Host-specific bacterial community profiles are quite common in the marine environment, however they have been sparsely investigated on bryozoans so far.

The main focus of the present study is the analysis of community profiles of bacterial associates on and within bryozoans.

The surface topography and/or the chemical influence of bryozoan metabolites with nutritious or allelochemical effects may significantly shape bacterial communities on the host surface.

In order to test these hypotheses, different locations for bacterial attachment and proliferation will be investigated, *i.e.* in and on the bryozoan, each with a "negative control":

1. Coelomic cavity of living bryozoans
   vs. interior of immersed bryozoan skeletons
2. Surface of living bryozoans
   vs. smooth substrate surfaces proximate to the bryozoan colonies.

The bacterial community profile will be examined by means of molecular biological methods such as DNA-extraction, PCR, denaturing gradient gel electrophoresis and concluding sequence analysis. Furthermore a screening for antibacterial substances is carried out with extracted bryozoan material in order to explain the putative differences in community profiles. Therefore marine bacteria from the Jade bight will be cultivated, isolated and tested for antibacterial effects in contact with the examined bryozoan species (stand disc susceptibility assay).

The results of the antibacterial screening in addition to the comparison between the viable and the non-viable conditions will allow conclusions for the reasons of potentially different bacterial community profiles on bryozoans.

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Biodiversity on coastal boulders at Spitsbergen

Piotr Kuklinski

Institute of Oceanology, Polish Academy of Science, ul.Powstanców Warszawy 55, Sopot 81-712, Poland (mailing address)University Center on Svalbard, P.O.Box 156, N-9171 Longyearbyean, Norway

David K. A. Barnes

British Antarctic Survey, High Cross, Madingley Road, Cambridge, CB3 0ET, United Kingdom

Boulder communities were studied in summer 2002 in West Spitsbergen fiords. We examined multiple samples at three stations in Kongsfjorden (79° N, 12° E) and three stations in Hornsund (77° N, 16° E) fjord. Horsund is more influenced by Arctic water masses while Kongsfjorden is by Atlantic warmer waters. Altogether 2752 boulders (of 254 681 cm^2 surface area) were investigated in the intertidal, 6 m and 12 m. 73 taxa of Bryozoa were determined; 1 to phylum, 1 to order, 3 to family, 16 to genus and 52 to species level. ANOSIM a priori statistic (Global R=0.141, p=0.016) reveal no difference between the investigated sites.

Cluster and multidimensional scaling analyses divided samples into two groups: intertidal samples and the rest of samples. Thirteen taxa (8 species) occurred in the intertidal zone whilst 73 taxa (52 species) were subtidal. All the intertidal taxa were also present in the subtidal samples. Communities were dominated by *Harmeria scutulata* (57% in of colonies in the intertidal and 54% in the subtidal). The next most abundant species, *Cauloramphus intermedius* and *Cribrilina annulata* represented just 5% of colonies each; the dominance values for the other taxa were below 5%. There was no diversity pattern along the depth gradient. In both fjords the highest values of Shannon-Wiener index were 2.7. Despite the distance between Kongsfjorden and Hornsund (over 200 km) and differences in hydrological features between the fjords no difference between their boulder communities.

Bryozoan mode of life in the high Arctic dynamic fjordic environment

Piotr Kuklinski[1) 2)]

[1)] *Institute of Oceanology, Polish Academy of Sciences, ul.Powstanców Warszawy 55, Sopot 81-712, Poland (mailing address)*

[2)] *University Center on Svalbard, P.O.Box 156, N-9171 Longyearbyean, Norway*

The aim of the study was to investigate the adaptations of bryozoans to life in dynamic environment of inner parts of arctic fjords. The study was carried on in West Spitsbergen fiords. The considered areas are characterized by high rate of sedimentation (up to 500g/m/24??), high concentrations of total suspended matter (500g/dm_???) in water, fine unstable bottom sediments, fresh water discharge from glaciers and rivers, cold stagnant waters at the bottom. Majority of the coastline in the inner part of the considered fjords is occupied by tidal glacier. This investigation is based on material collected during the r/v Oceania and r/v Jan Mayen expeditions to Svalbard in years 1997-2002. Research was carried out in four fjords: Hornsund, Van Mijen, Isfjorden and Kongsfjorden. Four main types of adaptations to the dynamic fjordic environment were observed: free-living, colonisation of drop-stones, colonisation of algae, creation of roots. Free living bryozoans are only represented by one species – *Alcyonidium disciforme* Smitt. This species by its shape (disc like) and encapsulation of sand particles within the zooarium (acting as ballast) is very much adapted to live on unstable fine sediments and to thrive high rate of sedimentation. "Faunistic islands" created by drop stones are acting as oasis of rocky fauna on unfriendly for suspension feeders (bryozoans) soft sediment. *Eucratea loricata* Linnaeus and *Dendrobeania murrayana* Johnston are dominants here. Very often algae growing on the drop-stones are the substrate for bryzoans. During this study three species of algae were investigated: *Desmarestia aculeata*, *Laminaria sacharina* and *Ptilota plumose*. *Harmeria scutulata* Busk and *Celleporella hyaline* Linnaeus are the most numerous species present on that kind of substrate. Root creating bryozoan was recorded very rarely. *Kinetoskias arborescens* Danielssen was the only species observed.

Boreholes, small drilling predators, and reparative growth in fossil cheilostome bryozoans

Scott Lidgard

Department of Geology, Field Museum of Natural History, 1400 S. Lake Shore Dr., Chicago, Illinois 60605, USA

One major evolutionary trend in cheilostome bryozoans is the broad secular increase of calcified armament of the frontal wall of the zooid, in all likelihood to protect the soft tissues inside from predators or mechanical stress. Reports of modern predators on bryozoans are dominated by omnivorous fishes and macroinvertebrate grazers, and by nudibranchs at the shallow extreme of bryozoan depth ranges. A survey of reported bryozoan predators reveals zooid-scale boring and demineralizing predators including turbellarians, nematodes, errant polychaetes, and both juvenile and adult prosobranch and opisthobranch gastropods. However, most taxonomic groups of small drilling predators on bryozoans are grossly underrepresented by collecting and observation biases, and thus their relative predation frequency is unknown. Some of these predators' feeding behaviors also circumvent skeletal armament by attacking fleshy everted polypides or boring through uncalcified zooid operculae without leaving skeletal boreholes. Skeletal/non-skeletal weight ratios and mechanical resistance to puncture suggest that for some drilling or demineralizing predators, dining on thickly calcified zooids may be overpriced energetically relative to consuming uncalcified zooids. Species with uncalcified frontal walls make up a disproportionately large percentage of all cheilostomes reported in these predators' diets. Fossil drilling predation is evidenced by small, centrally located and uniformly positioned boreholes. Yet this fossil evidence is actually quite sparse. Fossil cheilostomes from the Paleocene Vincentown Formation of New Jersey provide a rare example that meets both necessary and sufficient criteria to distinguish predatory borings from postmortem borings or other sources of holes in exterior skeletal walls. Fossil skeletal evidence of frequent reparative zooid budding in Lower Cretaceous taxa with uncalcified frontal walls supports the inference that zooid-scale predators were present from the earliest stages of cheilostome diversification.

Cheilostomate Bryozoa from the Bellingshausen Sea (Western Antarctica): results of the BENTART 2003 Spanish expedition

Carlos Mª López-Fé

Laboratorio de Biología Marina. Departamento de Fisiología y Zoología. Facultad de Biología. Universidad de Sevilla. Avda. Reina Mercedes, 6. 4102 Sevilla. Spain.

The Spanish Antarctic expedition BENTART 2003 was carried out in January and February 2003 by the oceanographic ship "B.I.O. Hesperides", and collected benthic material from an area comprised between the Antarctic Peninsula and Thurston Island. Most stations yielded bryozoans, usually on pebbles and rocks from a bottom mainly constituted by iceberg debris. At the moment of writting this abstract not all the material has been identified. Comparisons will be done between stations and with data from other expeditions and previously published works, in order to find affinities and differences with other areas of Antarctica.

Colonial fusion in relation to coancestry in *Celleporella hyalina*

Patricio H. Manríquez

Estación Costera de Investigaciones Marinas, Las Cruces & Center for Advanced Studies in Ecology & Biodiversity. Departamento d Ecología, Pontificia Universidad Católica de Chile, Casilla 114-D, Correo 22, Santiago, Chile.

Roger N. Hughes

School of Biological Sciences, University of Wales, Bangor, Gwynedd, LL57 2UW, UK.

John D. Bishop

Marine Biological Association of the UK, The Laboratory, Citadel Hill, Plymouth PL1 2PB, UK and Department of Biological Sciences, University of Plymouth, Drake Circus, Plymouth PL4 8AA, UK

Manipulated contact among fragments of adult colonies and early post-metamorphic colonies of *Celleporella hyalina* were used to investigate colonial fusion in relation to coancestry. Fusion trials demonstrated colonial fusion can occur after two colonies of *C. hyalina* make contact with each other at their natural growing edge. Experiments using colonies from the United Kingdom (Welsh populations) showed that coalescent zooids were strongly associated with inter-colonial fusion of manipulated contact among fragments of the same colony (isocontact). In the allocontact trials, fusion was mainly recorded in full-sib:full-sib and parent:F_1 offspring contacts. Similar results were found in contact among early post-metamorphic colonies produced by full-sib and half-sib larvae. No colonial fusion was recorded in contact among unrelated fragments of colonies or among early post-metamorphic colonies originated by unrelated larvae. Moreover, some fusion between half-sibs trials were recorded.

Experiments with Chilean specimens were conducted with colonies collected in two geographically distinct populations located ~1000 km apart (Antofagasta and Las Cruces). Within each geographic population, colonial fusion was recorded among early post-metamorphic colonies originated by larvae released from the same colony. In contrast, within each population no colonial fusion was recorded among pairs of postmetamorphic originated by two different colonies. These results, therefore suggest a strong association between colonial relatedness and fusion compatibility. Moreover, the total absence of both fusion among colonies from the two Chilean geographic populations and offspring of manipulated cross mating are in agreement with ongoing genetic studies by one of the authors (RNH). This suggests that each geographic population may represent a different species in the genus *Celleporella*.

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Measuring and analyzing morphological complexity in cheilostome bryozoans

Virginia A. Miller

Committee on Evolutionary Biology, University of Chicago and Department of Geology, Field Museum of Natural History, Chicago, IL, USA

The dramatic macroevolutionary trend of increasing complexity has provoked much discussion and speculation as to its cause(s), yet it has rarely been studied in a rigorous fashion. Many studies lack an explicit definition of complexity and/or fail to test observed trends for evidence of a driving force necessitating an evolutionary explanation. A primary obstacle to studying complexity is that it is difficult to define and quantify within organisms. The number of parts or part types is commonly used as a quantitative measure of complexity, but parts can be difficult to define. At present, the question remains: how can biological complexity be meaningfully quantified? Here I present a method for measuring complexity and analyzing observed trends within the cheilostome bryozoans.

Cheilostome bryozoans provide an excellent opportunity to investigate the evolution of complexity because their modular organization allows objective definition of parts. The modular units –zooids – of a bryozoan colony are developmentally equivalent and can objectively be considered equivalent parts of the colony. Following this logic, each morphologically distinct – polymorphic – zooid type is a distinct part type. The complexity of a cheilostome colony can therefore be quantified as a function of the number of polymorph types. Quantifying morphological complexity in this way provides a measure of whole-organism complexity, an improvement over previous complexity studies that measured complexity of a single component (*e.g.* the mammalian vertebral column) as a proxy for whole-organism complexity. The high degree of polymorphism within the cheilostomes and their extensive, well-sampled fossil record will permit comparisons of complexity within populations, within lineages, and among lineages through geologic time.

The maximum degree of polymorphism (complexity) in cheilostomes increases from their origin in the latest Jurassic to the present. It is not known, however, whether the increase is passive (a random walk away from a lower bound) or driven (the result of an evolutionary force). This distinction is important because a driven trend implies an evolutionary mechanism (such as selection favoring an increase in complexity), whereas a passive trend requires no such explanation. To distinguish between these two types of trends within the cheilostomes, I will analyze the distribution of complexity values both for cheilostomes as a whole and within subgroups. A positive skew of the data provides evidence for an active evolutionary mechanism; a skew of zero indicates a trend not significantly different from a random walk.

A preliminary study of the cheilostome bryozoans included in the *Synopses of the British Fauna* will be presented. The complexity of each genus will be measured by counting the number of described polymorphs. The complexity of these Recent cheilostomes will then be characterized by plotting the complexity values, both for the study group as a whole and within subgroups, and measuring skew. This study will determine whether the proposed measure of biological complexity will prove a fruitful avenue for studying complexity in cheilostome bryozoans.

Bryozoans in Messinian carbonate buildups of western Sardinia, Italy

Pierre Moissette

UFR Sciences de la Terre, UMR 5125 Paléoenvironnements & Paléobiosphère, Université de Lyon I, 27 Bd du 11 Novembre, 69622 Villeurbanne cedex, France

Jean-Paul Saint Martin & Frédéric Garcia

Centre de Sédimentologie-Paléontologie, UMR 6019, Université de Provence, 3 place Victor-Hugo, 13331 Marseille cedex 03, France

Jean-Pierre André

Laboratoire de Géologie, Université d'Angers, Bd Lavoisier, 49045 Angers cedex, France

Jean-Jacques Cornée

UFR Sciences de la Terre, UMR 5125 Paléoenvironnements & Paléobiosphère, Université de Lyon I, 27 Bd du 11 Novembre, 69622 Villeurbanne cedex, France

The Messinian (Late Miocene) Capo San Marco Formation of the Sinis Peninsula (Western Sardinia) contains numerous buildups that developed within a siliciclastic matrix (silty to sandy marls).

The biogenic buildups are made of abundant microbial carbonates constantly associated with serpulid worms and bryozoans. Other sessile and vagile benthic organisms are also represented: coralline algae, foraminifers, calcareous sponges, solitary corals, bivalves, gastropods (notably vermetids), brachiopods, crustaceans (ostracodes and decapods), and echinoids.
The microbialites constitute small bulbous and irregular masses, more or less anastomosed, or small pillars having a distinctive cauliflower-like shape. Serpulid tubes are often incorporated in the microbialite, but also occur within the sediment infilling. Bryozoans are always associated to the constructional processes. Erect rigid colonies, especially reteporiforms, but also small celleporiforms, first perform the important role of baffling and trapping mud-sized sediment. A complementary role is often played by numerous membraniporiform colonies coating the walls of cavities within the microbialite framework.

A total of 28 species of bryozoans have been identified in the study buildups. The two species having a major frame-building role, *Sertella septentrionalis* (reteporiform) and *Celleporina costazi* (celleporiform), occur in all bioherms where they are always abundant to very abundant. Six vinculariiform, one adeoniform and another celleporiform species are represented; they are less ubiquitous, but some of them also contribute to the construction. Although diversified (13 species) the membraniporiforms are much less abundant and conspicuous. Numerous segments belonging to five cellariiform species are found within the infilling sediment.

The major sedimentary and biogenic features of the serpulid-bryozoan-microbial buildups of western Sardinia are characteristic of a lower shoreface environment with intermittently agitated water, probably at depths of not more than 10-20 metres.

No modern analogues for these Messinian carbonate buildups exist, but Upper Palaeozoic mud-mounds and bioherms show strong biotic and structural similarities. In both cases, the intimate association of microbial communities with a variety of filter-feeding invertebrates, especially reteporiform bryozoans, has been recorded. Another common feature with the Messinian carbonate platform of Sardinia is the notable absence or the scarcity of hermatypic corals and calcareous algae.

Upwelling currents are suggested as contributing to the spectacular development of microbial carbonates, the abundance of filter-feeding metazoans and the dearth of corals. Not only cold deeper water are brought to the surface, but the increased nutrient levels are accompanied by the proliferation of microbial communities and numerous sessile invertebrates.

Microbial activity and frontal wall pore sieve plates in northeastern Pacific Microporellidae

Penny A. Morris

University of Houston Downtown, 1 Main St., Houston, Tx. 77002, USA

Dorothy F. Soule

Hancock Institute for Marine Studies, University of Southern California, Los Angeles, California 90089-0371, USA.

Pore plates among eastern Pacific species of the Microporellidae genera *Microporella* and *Microporelloides* appear to be restricted to members inhabiting the southern and central California coastlines. Frontal wall pores are circular, but vary in size, and pattern, and placement depth within the frontal wall pores. The apparent occurrence of pore sieve plates within a restricted geographical locality is intriguing, but more intriguing is the presence of recently "fossilized" biofilms, filaments and ooid shaped calcium carbonate particles that appear to be concentrated either on or in close proximity to the pore plates. The existence of microorganisms associated with bryozoans have been described by other authors from both modern and fossilized localities (*e.g.*, Scholtz 1995, Scholtz *et al.* 1995; Morris *et al.* 2002).

The present study is different in that it is directed towards specific morphological structures of the bryozoan colony. Analyzed samples, some of which were pre-treated with sodium hypochlorite, are compared both morphologically, using a scanning electron microscope (SEM), and elementally with an elemental energy dispersive x-ray system (EDS). Preliminary EDS analysis indicates high levels of calcium, as would be expected, and low levels of magnesium, sulfur, and usually phosphorous. Morphological analysis of all bryozoan samples indicates the apparent absence or low numbers of microbes that occupy the frontal walls. The pore plates appear to possess higher levels of microbial activity as evidenced by the variety of their remains. For instance, *Microporelloides setiformis* frontal wall pore sieve plates contain filaments, mineralized biofilms and coccoid forms. Pore plates from another species, *Microporella californica*, possess a flotsam of probable microbial debris composed of a variety of shapes and sizes. The interior surface of a *Fenestrulina farnsworthi* ascopore has biofilms and diatoms. In the same specimen, the interior surface of a frontal pore is plugged with punctuate, egg-shaped calcium carbonate particles with evidence of small coccoid particles and biofilms. The question asked is why is the existence of microbes and pore plates important? First of all, we do not know the significance of pore sieve plates, which occur in an apparently restricted geographical area. Are they a protection against a specific type of predator? Pore plates would reduce the size of the pore and possibly restrict entry from predators above a specific size.

Do microbes and their biofilms aid in the defense of a potential breach in the frontal wall membrane? Are the biofilms and their inhabitants active in preventing fouling of the surface and possibly part of an anti-predator brigade? Is there an evolutionary significance to these characteristics?

Bryozoa of the CIMAR-7 Expedition to the Aysenian fjords and channels

Hugo I. Moyano G.

Departamento de Zoología , Universidad de Concepción; Casilla 160-C; Concepción. hmoyano@udec.cl

Although studies on the bryozoans of the southern cone of South America have lasted more than 150 years and that have resulted in more than 200 species known so far, little is actually known of the bryozoans inhabiting the interior seas of Chiloé, Aysén and Magallanes. This lacking have been lessened during the last two decades by the collecting activities of Chilean, German and Italian cruices and expeditions to the Magellan straight areas and to channels and fjords situated north and south of it. Their faunal results allow to extend the geographical distributions of many species initially described from the Falkland and Burwood Bank areas up to Cape Horn and Magellan straight, what means a similarity of bryozoan marine faunas on both sides of the southernmost part of South America.

The Aysenian region intermediates between the Magellanian and Chiloean ones to south and north respectively and some zoogeographers have assumed to have also an intermediary zoogeographical role among a southernmost Magellanic province and a northenmost Peruvian-Chilean zoogeographical region reaching Chiloean fjords and channels. In order to assess this and other issues resulting from the isolation and lack of knowledge of the Aysenian area it was carried out the CIMAR-7 Expedition.

Bryozoans collected between 20 and 186 m depth in channels and fjords north to the Penas gulf, *v. gr.* Estero Elefantes near Laguna San Rafael National Park yielded typically Magellan species. Among these stand out *Chondriovellum angustilobatum, Beania maxilla, B. fragilis, Cellaria malvinensis, Callopora deseadensis, Aspidostoma giganteum, Nevianipora milneana, Smittina undulimargo* and *Romancheina labiosa.* The presence of the genera *Chondrovellum* and *Adeonella* reveals both vicariant relationships with Antarctica , South Africa and Australia and also a bryozoan similarity among external and internal fjors, islands and channels of the Magellan Madre de Dios area and the interior sea of the Aysenina region.

As a general conclusion the bryozoans collected by the CIMAR-7 Expedition indicate the existence of a typical Magellanic fauna in the inner Aysenian sea.

Some Upper Permian bryozoans from Svalbard, Arctic Norway

Hans Arne Nakrem

Geological Museum, University of Oslo, PO Box 1172 Blindern, NO-0318 Oslo, Norway

The Upper Permian (Ufimian-?Kazanian) succession of Svalbard comprises the upper part of the Kapp Starostin Formation (above the Vøringen Member) (a c. 350 m thick unit) in western and central Spitsbergen, and the Miseryfjellet Formation (c. 110 m thickness) of Bjørnøya, _ both units within the Tempelfjorden Group (?latest Artinskian-?Kazanian). The Ufimian-?Kazanian part of the Kapp Starostin Formation consists of silicified spiculitic shales ("cherts"), partly silicified limestones and locally developed glauconitic sandstones in the uppermost part. The Miseryfjellet Formation is made up of limestones (partly silicified) and more sandy units. A Permian hiatus separates the Tempelfjorden Group from the overlying soft Triassic shales.

The fossils in the investigated sections are typical Late Permian cold water forms, _ sponges (spicules), brachiopods, echinoderms and bryozoans. Corals and trilobites are rare, and other temperate to warm-water forms, such as fusulinid foraminiferans are absent. The age of the Upper Permian units of Svalbard is uncertain, and brachiopods, conodonts and palynomorphs have yet not given conclusive ages.

The shaley parts of the Kapp Starostin Formation is dominated by abundant *Ramipora hochstetteri* Toula, finely branched trepostomes (*Rhombotrypella*, *Stellahexaformis* and *Dyscritella*), cryptostomes (*Permoheloclema merum* Ozhgibesov, *Primorella polita* Romanchuk & Kiseleva and *Clausotrypa spinosa* Fritz) and minute fenestellids like *Rectifenestella pseudoretiformis* (Morozova), *Fabifenestella completa* Morozova & Kruchinina, *Alternifenestella greenharbourensis* (Nikiforova), *A. spitzbergenensis* (Nikiforova), *Lyrocladia vera* Morozova & Kruchinina, and *Polypora kossjensis* Ravikovich. Timanodictyids are also present in this association, with *Timanodictya nikiforovae* Morozova and *Gilmoropora heintzi* (Malecki). The partly silicified limestone units are dominated by thick trepostomes (species of *Tabulipora*, *Stenopora timanensis* Morozova and *Dyscritella parallela* Morozova), robust species of *Polypora*, *Acanthocladia* and *Reteporidra*. This division may reflect the recurrent changing depositional environments (quiet/ rough waters), or a selection through transport.

The identified faunas resemble closely Ufimian faunas described from Ellesmere Island (Assistance Formation) and Novaya Zemlya (Gerke and Savina Groups).

The Miseryfjellet Formation (?Kungurian-?Kazanian) of Bjørnøya shows a great variability and richness regarding both bryozoans and brachiopods. 30 bryozoan species have been identified. Typical taxa in the lower part of the Miseryfjellet Formation include *Rhombotrypella alfredensis* Morozova & Kruchinina, *Tabulipora greenlandensis* Ross & Ross, *Dyscritella bogatensis* Morozova, *Rectifenestella retiformis* (Schlotheim), *Septopora synocladiaformis* Nikiforova, *Polyporella optima* Morozova & Kruchinina, *Kingopora micropora* (Stuckenberg), *Timanodictya nikiforovae* Morozova, *Gilmoropora heintzi* (Malecki). Some new species appear in the upper

part: *Ramipora hochstetteri* Toula, *Stenopora grandis* Morozova, *Permoheloclema merum* Ozhgibesov, *Rectifenestella* cf. *gijigensis* (Nekhoroshev), *Lyrocladia* cf. *vera* Morozova & Kruchinina and *Polypora kossjensis* Ravikovich.

The investigated fauna shows a mixture regarding age assignment, as there are both Early and Late Permian species throughout this formation. There are species in common with the Lower Permian of Eastern North Greenland, the Urals and Timan, as well as with the Upper Permian of England (Zechstein) and the Urals. The lower part of this formation has species in common with the Vøringen Member (Spitsbergen) while some species in the upper part are common with the upper part of the Kapp Starostin Formation.

Fossil Bryozoa from Svalbard (Arctic Norway) _ a research history

Hans Arne Nakrem

Geological Museum, University of Oslo, PO Box 1172 Blindern, NO-0318 Oslo, Norway

The Svalbard Archipelago _ 74°-81° N and 10°-35° E _ was rediscovered by Willem Barents in 1596, and scientists began visiting the island group in the early 18. century. The first geological expedition was that by B. M. Keilhau in 1827. Keilhau visited Bjørnøya and Spitsbergen, and collected amongst other material Upper Permian bryozoans. Some of his brachiopods were described by L. von Buch in 1847 (for example *Spirifer keilhavii*), and he mentions *Fenestella antiqua* in the collection.

British expeditions to Svalbard brought new fossil material, including some Upper Permian bryozoans from Spitsbergen (*Stenopora* and *Fenestella*) collected by J. Lamont in 1859, mentioned by J. W. Salter in 1860. He discusses in detail a possible "new genus" which may very well be identical to *Ramipora hochstetteri* later described by F. Toula.
During an Austrian expedition in 1873 R. von Drasche brought back a collection of Upper Permian bryozoans from central Spitsbergen and Akseløya, subsequently described by F. Toula in 1875, and a new genus was erected, _ *Ramipora*, with *R. hochstetteri* as type species. Toula's description was supported by illustrations, and the fauna also includes other new species: *Polypora grandis* and *Phyllopora laubeï.*

Material from Spitsbergen was collected during British expeditions in 1906 and 1907 by W. S. Bruce, and subsequently described by G. W. Lee in 1908. Two new bryozoan species were described: *Stenopora cidariformis* and *S. brucei* both from the Kapp Starostin Formation (Kungurian-Ufimian age). O. Holtedahl published in 1911 and 1913 the first Early Permian bryozoans (no new species), with strong affinity with Early Permian faunas from Western Siberia.

Russian expeditions to Svalbard have taken place since the days of whaling and hunting, and during a Russian expedition to Bjørnøya in 1921 Upper Permian bryozoans were collected. P. I. Stepanov reported 11 bryozoan species (no new) from the "Spirifer Limestone". The first illustrated work based on internal characters in thin sections was published by A. I. Nikiforova in 1936. Four new species and one new subspecies described from Kongressdalen (Kapp Starostin Formation): *Fenestella greenharbourensis*, *F. spitzbergenensis*, *Polypora reteporidraeformis*, *P. timorensis* var. *greenharbourensis*, and *Septopora synocladiaformis*.

Recently described new Permian species from Svalbard: *Tabulipora siedleckii* Malecki 1968, *Hinganella heintzi* Malecki 1977 (=*Gilmoropora heintzi*), *Septopora phyllata* Malecki 1977 (=*R. hochstetteri*), *Septopora spitzbergensis* Lazutkina 1972, *Tabulipora greenlandensiformis* Lazutkina 1972. In an extensive work form 1986 I. P. Morozova & O. N. Kruchinina published many new species from the Upper Permian: *Cyclotrypa eximia*, *C. distincta*, *Tabulipora aberrans*, *Rhombotrypella alfredensis*, *Dyscritella lucida*, *D. minuta*, *D. maleckii*, *Dyscritellina fuglensis*, *D. arctica*, *Rectifenestella logica*, *Polyporella optima*, *Wjatkella assueta*, *Reteporidra*

tuncheimensis, *Gilmoropora unica* gen. & sp.nov. (=*G. heintzi*). In 1992 S. Sakagami published 44 taxa from the mid-upper Permian of Spitsbergen. In several works during the 1990s H. A. Nakrem described 45 taxa (one new: *Hinaclema svalbardensis*) from the Late Carboniferous (Moscovian) – Early Permian (Artinskian), and 40 taxa (four new species: *Meekopora magnusi*, *Fenestella akselensis*, *F. reversicnotta*, *Lyropora serissima*) from the Artinskian _ Kungurian. New species of Early Triassic bryozoans were described by Nakrem and Mørk in 1991: *Paralioclema winsnesi* and *P. mariaholmensis*.

Non-reproductive compatibility and morphologic differentiation in *Celleporella hyalina* (Linnaeus 1767) (Bryozoa, Cheilostomata) along the Chilean coast

Arturo H. Navarrete,

Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción, Casilla 297, Concepción, Chile.

Juan M. Cancino

Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción, Casilla 297, Concepción, Chile.

Hugo I. Moyano G.

Departamento de Zoología, Universidad de Concepción, Casilla 160-C, Concepción, Chile

Roger. N. Hughes

School of Biological Sciences, University of Wales, Bangor, Gwynedd LL57 2UW, UK.

Celleporella hyalina is an incrusting bryozoan which has been reported to have a cosmopolitan distribution. Such a wide distribution is surprising given the low dispersal capacity of the species, related to a free-swimming larval stage lasting only 1.5-4.0 h after release. To assess whether the so called *"C. hyalina"* from five different localities ranging 30° of latitude along the Chilean coast belong to a single biological species, in the present study we determined: a) reproductive compatibility between colonies from three of the localities, b) whether morphological differences in the number of pores formed per ovicell and/or in the early astogeny exist in colonies of the five localities, and c) the response in the number of pore per ovicell formed under two temperatures combined with two levels of oxygen concentration of the sea water in clones from only two localities.

Result of inter-locality crosses showed non-reproductive compatibility among the colonies from the three localities studied. The number of pores per ovicell in natural colonies, differed among the five localities. This difference was also detected in the frequency distributions of these variable among all localities, except the closest two. The early astogeny of *"C. hyalina"* coincided with that previously described by Cancino & Hughes (1988) for British waters in the laterality of the first zooid budded from the ancestrula. We also measured the angle with the first two zooids are budded from the ancestrula, but we found no significant differences among the five localities. The number of pores per ovicell, were in the four experimental conditions differed for different clones, showing phenotype plasticity, but of different tendency between the two localities.

These results showed that the morphologic of *"C. hyalina"* are variable among the five localities studied, and that specific characters such as ovicell pore number, are influenced by environmental conditions, but with a different tendency at different localities. These results added the no-reproductive compatibility among localities, strongly suggest that cryptic species exist along the Chilean coast under the single name of *"Celleporella hyalina"*.

Cell-lineage, larval types and entoproct-ectoproct phylogeny

Claus Nielsen

Zoological Museum (University of Copenhagen), Universitetsparken 15, DK-2100 Copenhagen, DENMARK. E-mail: cnielsen@zmuc.ku.dk

In spite of several recent studies, especially of RNA sequences, the phylogenetic position of Entoprocta and Ectoprocta is still uncertain. Morphological studies, including studies of embryology, remain important for our understanding of metazoan evolution, and a summary of our knowledge of the development of the two phyla could possibly clarify some of the uncertainty and point to interesting areas for new research.

Entoprocts have spiral cleavage and trochophora larvae with the cell-lineage of the prototroch corresponding to that of annelids and molluscs. Their adult morphology indicates that they may be regarded as spiralian protostomes that have become modified in connection with their sessile life-style. A closer connection to one of the other protostome phyla has not been identified.

Ectoprocts show various cleavage patterns: gymnolaemates have a pattern, which has been described as bilateral, whereas stenolaemates and phylactolaemates have an irregular pattern. Unfortunately, the cell-lineage of the first-mentioned type is poorly studied, and that of the second type is unknown. The planktotrophic cyphonautes larva appears plesiomorphic for the Gymnolaemata, and since several characters indicate that the stenolaemates are actually a gymnolaemate ingroup, the aberrant ontogeny of the stenolaemates needs not to be considered in this connection. The corona of gymnolaemate larvae (and the whole ciliated epithelium of the stenolaemate larva) consists of separate cilia on multiciliate cells and may be a modified prototroch. Unfortunately, the cell-lineage is not well described, and the origin of both endoderm and mesoderm seems open to discussion. The development of Phylactolaemata is obviously highly derived, but new investigations are needed before an interpretation can be attempted.

The position of the entoprocts within the "Spiralia" seems unquestionable, but the position of the ectoprocts is very uncertain. The ectoproct larva, cyphonautes, is of a very special type, which is difficult to compare with the two main types, trophophora and dipleurula. New studies on feeding of both larval and adult *Phoronis* show considerable functional similarities with that of gymnolaemates, but there are important structural differences. New studies on cell-lineage of gymnolaemates could well contribute considerably to our understanding of the phylogenetic position of the ectoprocts.

Submarine Freshwater Springs: A Unique Habitat for the Bryozoan *Pentapora fascialis*

Maja Novosel

Faculty of Science, Dept. of Biology, Rooseveltov trg 6, 10000 Zagreb, Croatia

Goran Olujic

Hydrographic Institute of the Republic of Croatia, Zrinsko-frankopanska 121, 21000 Split, Croatia

Silvia Cocito

ENEA Marine Environment Research Centre, P.O.Box 224, 19100 La Spezia, Italy

Antonieta Pozar-Domac

Faculty of Science, Dept. of Biology, Rooseveltov trg 6, 10000 Zagreb, Croatia

Large colonies of the bryozoan *Pentapora fascialis* growing inside the plume of submarine freshwater springs (*vruljas*) has been surveyed. In the surveyed area, *P. fascialis* grows only under the influence of *vrulja's* outflow, at the depth range from 35 m to 1 m. We have investigated the water composition and the temperature of the *vrulja's* plume. The amount of nutrients and carbonates coming from *vrulja's* plume were measured during winter and summer conditions. The amount of nutrients (nitrate, nitrite, phosphate, ammonia and silicate) has been considerably higher inside the *vruljas* than in the seawater. Furthermore, the amount of total CO_2, dissolved CO_2 and bicarbonate has been higher inside the plume, while carbonate had lower values inside *vruljas* plume than in the seawater. The temperature of *vrulja's* outflow was constant throughout the year and varied between 9,76 and 11,16°C, while the seawater temperature varied between 8,22 and 23,52°C at 25 m of depth.

Reproductive life histories of Central American cupuladriids

Aaron O'Dea

Smithsonian Tropical Research Institute, Box 2072, Balboa, Ancon, Republic of Panama. email: odeaa@si.edu

Free living bryozoans are able to produce new colonies both sexually via larvae and asexually via fragmentation and regeneration. It is clear that the proportion of sexual to asexual colonies within species is linked to colony morphology yet thus far the subject remains remarkably understudied. This is surprising given the potential application of such models to answer numerous ecological and evolutionary questions. Cupuladriids in Central America are ideal for such investigation because they are a relatively diverse free-living fauna, they show a considerable range in the ratio of colonies produced sexually to asexually, are a variety of shapes and sizes and are exceptionally abundant both today and over the last 15 million years. In a marine survey from either side of the Isthmus of Panama nearly 32,000 cupuladriids were collected, identified and sorted.

We calculated the proportion of sexually to asexually propagated colonies, the rates of fragmentation and the ability of species to regenerate following breakage. Some species were found to persistently fragment and regenerate and thus maintain their populations almost entirely asexually, while other species are found to never fragment thereby maintaining their populations entirely through the sexual production of larvae. We correlated these measures with basic empirical data on morphology showing that species that produce large, lightly calcified colonies are more likely to fragment while species that produce determinately growing and heavily calcified colonies are less likely to fragment. This provides compelling empirical evidence that colony morphologies are, in part, adaptations to different reproductive life history strategies in cupuladriids. Placing these data within a phylogeny of cupuladriids suggests that life histories are not generally constrained among clades. Life history strategies are however found to be distinct in species between environments across the Isthmus of Panama, strongly suggesting that environmental and ecological differences are more important in determining life history variations.

Coastal seasonality during closure of the Isthmus of Panama

Aaron O'Dea

Smithsonian Tropical Research Institute, Box 2072, Balboa, Ancon, Republic of Panama. email: odeaa@si.edu

Jeremy B.C. Jackson

University of California at San Diego, Scripps Institution, La Jolla, California 92093-0244. U.S.A. email: jbcj@ucsd.edu

Understanding the relationship between oceanographic and biological change in response to the formation of the Isthmus of Panama has so far been confounded by a paradox; high-resolution oceanographic data comes from off-shore deep-sea sediments, while data on biological change comes from near-shore coastal fossil formations. This study uses zooid size analysis in fossil cupuladriid bryozoans to compile high-resolution estimates of seasonal upwelling in Central American Neogene coastal environments that can be compared directly to data on biological change. Until 3.5 million years ago, strong seasonal upwelling was influencing Caribbean coastal waters. After this time upwelling ceased in the Caribbean, signifying the start of the present day Caribbean environment, and providing a reliable date of final closure of the isthmus. It appears, as has been suggested, that major regional oceanographic changes are not contemporaneous with major regional biological change, and that a global solution is required.

Metapopulation ecology of freshwater bryozoans: spatial and temporal contributions to gene flow and genetic diversity

Beth Okamura

School of Animal and Microbial Sciences, PO Box 228, University of Reading, Reading, RG6 6AJ, United Kingdom

Joanna Freeland

Department of Biological Sciences, Open University, Milton Keynes, MK7 6AA, United Kingdom

Our work on the population genetic structure and ecology of *Cristatella mucedo* has provided compelling evidence for conformation to a metapopulation structure in Europe. This was first supported by RAPD-based studies, but has been greatly strengthened by the use of microsatellite markers. The latter indicate low, ongoing levels of gene flow across northwest Europe, a region traversed by annual waterfowl migratory routes. In contrast, there was virtually no evidence of connection between North American populations sampled from a region of divergent migratory routes. These results provide some of the strongest evidence to date that waterfowl transport propagules of freshwater organisms. The positive relationship between gene flow and genetic diversity suggests that immigrants contribute to local genetic diversity; however, a temporal study of a population which underwent a crash has suggested that statoblast banks may also influence patterns of demography and genetic diversity. A significant feature of nearly all populations that we have genetically characterised is an excess of homozygotes and lack of conformation to Hardy-Weinberg equilibrium. These results could reflect inbreeding or selfing but may also be explained by a Wahlund Effect (a result of sampling an admixture of genetically differentiated populations). Microsatellite genotyping of parental colonies and their larval offspring has indicated that selfing is unlikely to explain the large observed heterozygosity deficits. Our current programme of research is to determine the role of statoblast banks in contributing to demography and genetic diversity of *C. mucedo* populations. This will be done by inferring temporal gene flow from statoblast banks through a combination of empirical and collaborative modelling studies.

Bryozoans and their mysterious myxozoan parasites

Beth Okamura, Sylvie Tops & Samantha Hill

School of Animal and Microbial Sciences, The University of Reading, Whiteknights, PO Box 228, Reading, RG6 6AJ, United Kingdom

In 1996 the first myxozoan parasite in freshwater bryozoans was described from infected colonies of *Cristatella mucedo* and was named *Tetracapsula bryozoides*. The subsequent discovery and description of a sister species, *Tetracapsula bryosalmonae*, resulted in identification of the source of the economically devastating proliferative kidney disease (PKD) of salmonid fish and the description of a new myxozoan class, the Malacosporea. This provoked considerable interest and funding for ecological and taxonomic studies of phylactolaemates associated with PKD outbreaks on a wide geographic scale. A result of such investigations was the occasional encounter of the wormlike endoparasite, *Buddenbrockia plumatellae*, described by Schröder in 1910 and identified by Nielsen in 2002 as one of the last five enigmatic animal taxa. Ultrastructural and 18S rDNA sequence information led to the surprising conclusion that *B. plumatellae* is a malacosporean whose wormlike body plan considerably adds to our understanding of the biodiversity and evolution of the Myxozoa and demonstrates that bryozoans have played a significant role in myxozoan evolution.

Our studies have also resulted in the first insights into the ecology and pathology of myxozoans parasitic in bryozoans as well as discovery of a new parasite of the rare *Lophopus crystallinus*. We can expect that further encounters of malacosporeans parasitic in bryozoans and perhaps in other hosts will help to resolve the diversity of this clade of myxozoans and the importance of bryozoans as hosts.

Freshwater bryozoans in central Chile

María Cristina Orellana.

Departamento de Ecología Costera, Facultad de Ciencias, Universidad Católica de la Santísima Concepción. Alonso de Ribera 2850, Concepción Chile.

The studies of Phylactolaemata are very few in South America, and in Chile are restricted to only 2 published reports. The present study aims at assessing the presence of fresh water bryozoans in central Chile. Lakes and ponds were sampled near Concepción and 200 km north (35° 41' S to 36° 50'S). Bryozoans colonies and sessoblasts were collected from leaves, stems and roots of aquatic plants, floating objects and wood material. Floatoblasts were sieved from surface water using a 100µm mesh. Samples were taken to the laboratory, observed under the binocular microscope, subsamples of statoblasts were studied with scanning electron microscope, while others were allow to germinate in order to obtain information required to identify the species.

Phylactolaemates were present in the five places sampled, the species presents were *Fredericella sultana, Plumatella mukai, P. casmiana, P. repens* and *P. patagonica.* A further non-identified species was also present. The maximum number of species present in a given lake was three, while the minimum was one. *P. mukai* was the only species present in all the lakes and ponds studied.

The present study provide the first records of *P. casmiana* and *P. repens* in Chile, and enlarge the known area of occurrence of *F. sultana* and *P. patagonica.*

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Brood chambers constructed from spines and costae in fossil and Recent cheilostome bryozoans

Andrew N. Ostrovsky

Department of Invertebrate Zoology, Faculty of Biology & Soil Science, St. Petersburg State University, Universitetskaja nab. 7/9, 199034, St. Petersburg, Russia

Paul D. Taylor

Department of Palaeontology, The Natural History Museum, Cromwell Road, SW7 5BD, London, United Kingdom

A comparative study was undertaken of fossil and Recent cheilostomes with brood-chambers constructed of spines and costae in order to interpret possible stages in the early evolution of cheilostome ovicells, especially within the Calloporoidea (Calloporidae), Microporoidea (Monoporellidae) and Cribrimorpha (Cribrilinidae). Spinose and costate ovicells are common in the Late Cretaceous where they have been found in 26 species. Costate and spinose ovicells are also found in 3 Eocene-Miocene fossil species and 5 Recent species.

The earliest cheilostome ovicells probably evolved in a mid-Cretaceous calloporid by the bending towards the maternal zooid of a group of mural spines belonging to the distal zooid. The bases of these ovicell spines were initially aligned in a distally concave row that later became straight, and finally distally convex and horseshoe-shaped, affording progressively better protection for the developing embryos. We suggest that primitive monoporellids inherited from calloporid ancestors a distally concave arrangement of ovicell spine bases, while cribrimorphs inherited a horseshoe-shaped arrangement. A horseshoe-shaped pattern found in *Macropora* might independently have evolved from the distally convex row in coilostegans. Other important trends in early ovicell evolution included: (1) loss of basal spine articulation, (2) spine flattening, and (3) development of a concave ovicell floor. Conventional 'unipartite' ovicells may have originated either through spine fusion, as seems likely in some cribrimorphs, or from a progressive loss of spines via an intermediate stage, seen in some calloporids and in *Monoporella multilamellosa*, in which the ovicell comprises a pair of large, flattened spines. Hypostegal coelom evolved in the spinose ovicells of some monoporellids. The acanthostegous brood-chambers found in *Tendra* apparently provide an example of independent evolution of spinose structures for brooding larvae. Thus, spinose brood-chambers probably evolved at least twice in the Cheilostomata.

Ovicell development in the early calloporid *Wilbertopora* (Bryozoa: Cheilostomata) from the mid-Cretaceous of the USA

Andrew N. Ostrovsky

Department of Invertebrate Zoology, Faculty of Biology & Soil Science, St. Petersburg State University, Universitetskaja nab. 7/9, 199034, St. Petersburg, Russia

Paul D. Taylor

Department of Palaeontology, The Natural History Museum, Cromwell Road, SW7 5BD, London, United Kingdom

The calloporid *Wilbertopora* is the oldest known cheilostome with brood chambers (ovicells). The pattern of initial ovicell formation, involving a single ooecial rudiment, is more reminiscent of ovicell development in some Recent cribrimorphs and other more advanced cheilostomes than it is of Recent calloporids that have a double rudiment. The distrubution of early ovicell developmental types among cheilostomes is discussed. During later ovicell growth in *Wilbertopora* two lateral lobes fuse to form the hemispherical hyperstomial ovicell. This fusion process demonstrates how such ovicells could have originated from a more primitive bispinose precursor.

Towards a molecular phylogeny of the cheilostomate Bryozoa; insights from the CO1 and 18s rRNA genes

Joanne S. Porter, David O.F. Skibinski & Peter J. Hayward

School of Biological Sciences, University of Wales Swansea, Singleton Park, Swansea SA2 8PP, Wales, UK.

Sequences obtained from a wide variety of cheilostome Bryozoa have been used in a phylogenetic analysis. The data from the two genes are analysed separately using Maximum Likelihood and Bayesian approaches. The data are also combined and analysed using the baseml program of PAML software allowing calibration of evolutionary rates, using the fossil record where known and allowing inference of evolutionary rates where the fossil record does not permit calibration. The results of these methods are discussed in the light of current classifications of the cheilostomes, with particular reference to frontal wall evolution.

Bryozoan facies in deep-sea Pleistocene environments of southern Italy

Antonietta Rosso

Dipartimento di Scienze Geologiche, Università di Catania, Corso Italia, 55 – 95129 Catania, Italy.

Deep-sea deposits of Pleistocene age are rather common in southern Italy. There the strong Plio-Quaternary tectonic activity, involving extensive vertical displacements, allowed small post-orogenic basins to develop, often till bathyal depths. Infilling sediments usually deposited in proximal palaeoenvironments, normally affected by sintectonic activity. Presently, outcroppings expose rapidly shallowing or deepening successions, often including deep-water fossiliferous siliciclastic or mixed sediments, sometimes side by side with fossilised deep scarp-faults, once bordering the paleobasins.

Fossil assemblages, although biased by diagenesis, are usually preserved *in situ* thus reflecting original palaeocommunities. Bryozoans are always present, their assemblages usually rich and diversified. Within them, several facies can be distinguished, notwithstanding some superficial similarities, essentially caused by the common dominance of species such as *Tessaradoma boreale*, *Exidmonea triforis* and *Tervia irregularis*. The recognised facies appear to be mainly related to bottom features: a hard bottom community plus several soft bottom facies, each linked to different bottom grain sizes, have been identified. In addition differences can be detected also in relation to depth, with changing composition involving species replacement.

The deep-sea hard bottom facies is oligospecific, characterised by a few, typically encrusting, mainly uniserial running species. Also the extremely pure foraminiferal ooze community seems particularly scant and tends to be monospecific, usually comprising only the rooted species *Batopora rosula*. In contrast silts, sandy silts and sands, locally enriched in gravelly, mainly biogenic, fraction, show rich and diversified bryozoan assemblages. Nevertheless, all the recorded taxa are small-sized and show growth adaptations to colonise soft bottoms. Most species, usually accounting for highest percentages, possess erect, both rigid and flexible, colonies involving exiguous encrusting bases or the presence of rhyzooids. Locally "free-living" setoselliniform species can become dominant.

Bryozoans near the Ordovician/Silurian Boundary

June R. P. Ross[1] & Charles A. Ross[2]

1 Department of Biology and 2 Department of Geology, Western Washington University, Bellingham, Washington, 98225, USA

The Drakes Formation, in central and northern Kentucky, has been considered upper Ordovician and is the upper part of the Richmondian Stage of the Cincinnatian Series. It is composed of four members (from its base): Rowland, Bardstown, Preachersville, and Saluda. Within this succession, there are four major depositional sequences, however, the sequence boundaries (SB) are not always precisely at the member boundaries. This succession is overlain by the Lower Silurian Brassfield Limestone (upper Aeronian and lower Telychian stages).

The Drakes Formation rests on a number of different subjacent members of the Bull Fork and Ashlock formations and data from Weir *et al.* (1984, USGS PP 1151-E) is interpreted by us as a regional unconformity that has at least 60 m of topographic relief in the area of the Cincinnati Arch. The bryozoans, such as *Rhombotrypella*, *Parvohallopora*, *Constellaria*, *Bythopora*, and *Graptodictya*, have been deposited in shallow water in mostly silty calcarenites.

Geographic variation in zooid size in two west European species of *Alcyonidium* (Ctenostomatida)

John S. Ryland & Joanne S. Porter

School of Biological Sciences, University of Wales Swansea, Swansea SA2 5DP, UK

Two smooth-surfaced encrusting species of *Alcyonidium* are commonly found associated with intertidal algae on western European shores: *A. gelatinosum* and *A. polyoum.* Lacking skeletal and other strong morphological characters, zooid size may be important in defining species, but might be influenced by ambient sea temperatures. More than 140 collections comprising one or both species have been made between 1992 and 2003 at locations within the geographic limits 42ñ62 N and 11 Wñ15 E. They were obtained from 28 of 48 geographic cells, 2 latitude ◊ 2 longitude, which include significant coastline, and for which sea surface temperature (SST) data (mean annual, mean monthly maximum and minimum, and range) are available from satellite imagery (Land-Ocean Interactions in the Coastal Zone (LOICZ) Project of the International Geosphere-Biosphere Programme (IGBP)).

A. polyoum is the more southerly species, ranging from Spain and southwest France, around Ireland to northern Scotland; *A. gelatinosum* is distributed from north Brittany, around Ireland and Britain to Shetland and east throughout Denmark, but does not reach southwest Iceland; it is overall the more abundant of the two. Twenty zooid lengths and widths from five colonies in each collection have been measured by video-based image analysis. Length and width were found frequently not correlated, so size has also been visualized as zooid surface area, though area has a much higher coefficient of variation than length. The relationships of both expressions of size to temperature have been analysed by univariate statistical methods; the differences between colonies within a locality were often significant.

The pattern of sea surface temperature throughout the region is very complicated, with east-west as well as north-south trends. Variation in mean size between locations is considerable but simple geographic clines appear not to exist. Relationships with SSTs are unclear (there being no significant correlations), perhaps because the thermal regimes of coastal sites and bays are not well characterized by the larger scale open sea data here employed. Within and between station variability in size, and the relationships of size to temperature will be discussed in the context of relevant published information, together with the taxonomic implications (specific to these species and wider) of both sources of variability.

The genus *Myriapora*: Pathways of evolution

Priska Schäfer & Beate Bader

Geologisch-Paläontologisches Institut, Christian Albrechts Universität Zu Kiel, Olshausenstrasse 40 D-24118 Kiel Germany

Myriapora is an evolutionary young genus restricted to the Northern Hemisphere. It is known with six species from mid-Tertiary to modern times. The genus first occurred with *M. fungiformis* in Oligocene near-coast sediments of epicontinental Europe. Today, the genus is known from Mediterranean waters (type species *M. truncata*) and from polar environments (*M. coarctata, M. subracilis and M. orientalis*). *M. bugei* occurs in subtropical waters of the southern North Atlantic. Based on skeletal morphology, ultrastructure and ecologic aspects a phylogenetic tree for *Myriapora* is suggested. Within this tree *M. bugei* is outgrouped from the genus whereas the remaining species form a monophylum, which includes *M. fungiformis* as a stemgroup and *M. subgracilis, M. coarctata* and *M. orientalis* as a sister group of *M. truncata*.

Geochemical proxies and life strategies of bryozoans: A comparison of polar and temperate species

Priska Schäfer & Beate Bader

Geologisch-Paläontologisches Institut, Christian Albrechts Universität Zu Kiel, Olshausenstrasse 40 D-24118 Kiel Germany

Stable isotopes in carbonate skeletons of marine organisms are considered a powerful proxy to reconstruct changes in the oceanic environment. To test this hypothesis for bryozoans, various bryozoan taxa from polar (Arctic, Antarctic) and temperate waters (British Channel) were selected for isotope analysis. Isotope curves along vertical profiles through skeletons were found to clearly reflect seasonal variations in temperature and food supply. The _^{13}C curves were found to parallel _^{18}O curves in the temperate species *Cellaria sinuosa*. High values were found during winter whereas low values occur during summer. This pattern suggests that (1) carbon isotope compositions depict seasonal variations in productivity of water masses and (2) the carbon for skeletal growth is to a large extent taken from the organic reservoir (phytoplankton). The _^{13}C profiles, however, depict a steep increase of values during the summer/autumn of the second year of colony growth when reproduction occurs. This pattern is considered to depict a switch of carbon uptake for skeletal growth during times of reproduction, switching from the organic (food) toward the inorganic (seawater) reservoir.

Stable isotope profiles in bryozoan skeletons from both Arctic (*Myriapora* div. sp.) and Arctic/Antarctic waters (*Hornera* div. sp.), again, reflect a congruent pattern of _^{18}O and _^{13}C values according to seasonal temperature and productivity cycles. In contrast to temperate environments with several seasonal peaks in productivity, _^{13}C values in Arctic/Antarctic colonies reflect only one productivity peak per year. This pattern may be further intensified by the reduced growth rates of these polar taxa. Instead, the _^{18}O isotopes display a distinct decrease of values from colony base to tip indicating a secondary thickening of older parts of colonies during winter in times of reduced linear growth. The _^{18}O profile is contrasted by the _^{13}C profile, the latter of which displays a distinct increase of values from base to top of colony. This, again, might refer towards a change in the carbon reservoir used for skeleton mineralisation with increasing colony age.

The aforementioned observations prove the stable isotope signature in bryozoan skeletons to monitor seasonal changes in the ocean environment. Whereas _^{18}O values archived in the skeletons are largely in equilibrium with the ambient seawater _^{18}O values, data also hint at a strong biological control on the carbon isotope composition.

Growth pattern and life cycles of the bryozoan *Flustra folicaea*: A comparison of North Sea and Baltic Sea populations

Priska Schäfer & Beate Bader

Geologisch-Paläontologisches Institut, Christian Albrechts Universität Zu Kiel, Olshausenstrasse 40 D-24118 Kiel Germany

Elena Nikulina

Russian Academy of Sciences, Paleontological Institute, Laboratory of Higher Invertebrates, 123 Profsoyuznaya Str. Moscow 117321 Russia, elnik114@mtu-net.ru

The cheilostome species *Flustra foliacaea* is widespread in the North Sea and occurs as far eastward as into the western part of the Baltic Sea. It seems that water salinities of 10-15‰ set a limit to the distribution of the species. Living colonies of *F. foliacaea* were collected both from the Steinsgrund off NE Helgoland (North Sea) and from near-coast settings off SW Lolland (Baltic Sea). In both areas, colonies dwell on gravelly lag deposits of glacial moraines. The North Sea and Baltic Sea populations, however, differ distinctly by their colony growth forms and zooid architecture. Variations in morphology, in life span and colony growth rates are discussed with respect to the characteristics of the surrounding environments.

Enigmatic Palaeoenvironments of Eocene Bryozoa, St Vincent Basin, South Australia

Rolf Schmidt

Museum Victoria, PO Box 666E, Melbourne, Victoria 3001, Australia

Yvonne Bone

Geology & Geophysics, University of Adelaide, Adelaide, South Australia 5005, Australia

The diverse facies of the Eocene sediments of the St Vincent Basin, South Australia, contain a wide range of bryozoan faunas, ranging from high to low diversity and abundance assemblages, regarding both taxonomy and growth forms. The small basin, was probably often restricted from the open ocean by a basement high (today's Kangaroo Island). The initial transgressive marine facies on all basin margins saw the greatest diversity and abundance of bryozoans. This represents a well oxygenated and moderate energy environment. Each margin has a very different sequence of assemblages. The only distinct common trend is the presence of 'sand-fauna' taxa in the lower sediments, which decrease and vanish up-section.

The eastern margin consists of a series of embayments containing similar sedimentary sequences. The high abundance and diversity bryozoan assemblages of the Middle Eocene Tortachilla Limestone (almost 200 species in the middle member) confirm this as a normal marine facies. High sea levels probably flooded the Kangaroo Island basement high to allow sufficient open ocean access. Although the sediments appear similar throughout, there are distinct trends in the bryozoan assemblages, such as a steady decrease in encrusters and articulated zooidal forms up-section. There is also a reduction in growth form diversity. The Upper Eocene Blanche Point Formation is silica and organic carbon rich with abundant sponge spicules, *Thalassinoides* burrows and turritellid gastropods, indicating a stressed environment. Occasional horizons of bryozoans are dominated by multilaminar *Celleporaria*, Phidoloporidae and a new genus of Onychocellidae, which represent short intervals of more normal marine conditions allowing only early opportunistic colonisers to flourish. This indicates a relative shallowing, allowing the Kangaroo Island High to restrict open ocean access, rather than the traditional interpretation of deepening.

The western margin had a steeper palaeotopography and the sediments are more siliciclastic. The Middle Eocene Mulloowurtie Formation is mostly silty and contains mainly scattered nodular bryozoans. The only diverse assemblage occurs locally on a granite 'island' (119 species) with a similar composition and diversity to the Tortachilla Limestone. The Upper Eocene Lower Rogue Formation is siliciclastic and only few horizons contain bryozoans. These assemblages are dominated by articulated branching Cellariidae. This margin was dominated by rivers and the resulting high sedimentation rate and low salinity inhibited bryozoan colonisation.

The southern margin Kingscote Limestone is echinoid and serpulid dominated and contains medium diversity bryozoan assemblages throughout (22–57 species). These assemblages are consistently dominated by articulated branching Cellariidae. This was probably a shallow passage through a chain of 'Kangaroo Islands'.

The restricted nature of the basin (low energy and stratification) may have created environments normally typical of deep water in a shallow basin.

Diversity of laminar bryozoans and microbial fouling on laminar shallow marine bryozoans of Japan and New Zealand

Joachim Scholz

Research Institute Senckenberg, Section ME III, 60385 Frankfurt am Main, Germany.

Shunsuke F. Mawatari

Division of Biological Sciences, Graduate School of Science, Hokkaido University, Sapporo, 060-0810 Japan

The environmental distribution of encrusting bryozoans settling on disarticulated and living bivalve shells has been recorded in 2000 and 2002 from five stations in Japan and New Zealand. Some insight into the observed distribution patterns emerges from information on the interaction with microbial mats. Advancing existing classifications, we have subdivided the encrusting bryozoan morphotypes into seven different growth types that largely reflect the biological potentials of bryozoans in competition for space on substrate surfaces. The frequency distribution of these types (s-/c-/m-/z-laminae, runners, spots, bryostromatolites) reveals the influence of microbial mats as a control factor of bryozoan substrate coverage. Microbial mats in turn are correlated with latitudinal gradients in Japan and New Zealand from cool-temperate to subtropical and tropical waters. The latitudinal diversity of microbial mats and biofilms accounts for bryozoan species diversity patterns due to adding complexity to substrate surfaces.

Epizoic biofilms growing on the sampled bryozoan colonies are remarkably heterogeneous. Even colonies sampled at the same locality and time rarely if ever have biofilms of unique consistency. Generally, biofilm fouling of bryozoans is lower in warm water environments than in the cold water settings studied. This is particularly obvious considering the sampling period of May/June 2000, although a similar trend is also visible comparing sampling sites of the period of October 2002.

Unlike erect bryozoans, laminar ones are probably underrated as facies fossils. Accordingly, laminar bryozoan growth types are reconsidered as a tool for paleoecological interpretation of marine hardground communities.

Infestation of a temperate reservoir by freshwater bryozoans – an integrated research programme

Abigail M. Smith & Michelle A. Brunton

Department of Marine Science, University of Otago, P. O. Box 56, Dunedin, New Zealand

Freshwater bryozoans *Paludicella articulata* and *Plumatella repens* grow on hard surfaces, in water intake pipes, on floats, and throughout the microstrainer hall at Southern Reservoir and the associated water treatment station in Dunedin, New Zealand. Their presence has become a severe problem since 1996, intermittently affecting normal operation of the plant, particularly when clumps are torn off the sides of pipes and walls, clogging microstrainers and causing considerable damage. Bryozoans living in pipes may also reduce effective pipe bore diameter and thus slow water velocities. The presence of fouling bryozoans increases workloads, reduces efficiency, and may impede the delivery of drinking water to Dunedin residents.

Dunedin City Council Water Department and *AMS Research* have devised a multi-staged research approach to the problem of fouling by freshwater bryozoans. Initially, reviews of the literature for both *Paludicella articulata* and *Plumatella repens* were carried out, revealing the international extent of bio-fouling by these species. A survey of the microstrainer hall at Southern Reservoir showed that only these two species of freshwater bryozoans occur there, though there is the possibility that other species present in southern NZ could arrive. A more detailed survey of Dunedin's water treatment facilities and intake streams discovered four species present in Dunedin's reservoirs, but none in fast-running streams. Along with these surveys to ascertain the magnitude of potential fouling, there has been an active experimental programme, including investigation of control strategies and water treatment programmes on settlement of freshwater bryozoans, ongoing monitoring over three years of the populations in the microstrainer hall at Southern Reservoir, an international study of the genetic affinities of the Dunedin *Paludicella articulata* population, and a longer-term project investigating the effects of extreme conditions on the resting stages (hibernacula and statoblasts) of Southern Reservoir's bryozoans.

This wide-ranging research programme has allowed the Dunedin City Council Water Department to understand the scope of the infestation, to limit the potential for further colonisation by these and other species, and to design strategies for controlling the problem.

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Women in the International Bryozoology Association, 1965-2004

Abigail M. Smith

Department of Marine Science, University of Otago, P.O. Box 56, Dunedin, New Zealand

Throughout its 39-year history, the International Bryozoology Association (IBA) has had women among its members. At its first conference, in 1968, for example, 6 women appeared in the conference photo (13% of the people there); one of these women will likely appear in this conference's 2004 photo! Conference photos, membership lists, and conference volumes illuminate some interesting trends in participation by women in the IBA. Of the 16 founding members, three were women (19%). In the 1970s and 1980s, women made up 21-28% of the people in the conference photo. By 2001, 38% of the conference photo were female, and 52% of the membership list are women. This overall increase in proportion of members and conference attendees is fairly consistent over time.

Women have been active in management and administration of the IBA. They have served as conference co-hosts at almost every conference since 1977, as association secretaries, treasurers, and council members (since 1965), and one term as president of the Association (1992-1995).

In contrast, the number of female authors in conference proceedings has not varied greatly over the same time. Women made up 22% of authors in the 1968 Milan volume, compared with 27% in the 2001 Dublin volume. In general, however, early papers were mostly by women who chose to publish alone; today more women are publishing in mixed-gender groups.

Overall the IBA has an admirable record of including and promoting woman scientists, which has added much to the strength and relevance of the Association. The presence of women adds diversity both in approach and standpoint. Many key contributors to bryozoan science over the years have been women. These senior women may act as role models and mentors for younger women, ensuring that women will always occupy an important place at the IBA.

Bryozoa of the Mission Argillite (Permian), northeastern Washington

Edward M. Snyder

Institute for Environmental Studies, Shepherd College, Shepherdstown, WV 25443, USA

Ernest H. Gilmour

Department of Geology, Eastern Washington University, Cheney, WA, 99004, USA

Fifteen species of Late Permian bryozoans occur in a biohermal bank in the Mission Argillite of northeastern Washington. These include two species conspecific with species described from Japan and 13 new species, one of which is the type species of a new genus.

Tectonostratigraphic terranes thought to be allochthonous to North America include the Eastern Klamath terrane in northern California, the Quesnellia terrane in northeastern Washington and southern British Columbia, and the Slide Mountain terrane in northern British Columbia (Monger and Berg, 1987; and Silberling *et al.*, 1987). Ross and Ross (1983) cited fusulinid occurrences in these terranes as evidence for a southern geographic origin, and concluded that their present widespread occurrences in the western Cordillera were the result of allochthonous terranes being accreted to North America during the Mesozoic. The presence of two species of bryozoans, *Dyscritella iwaizakiensis* Sakagami, 1961, and *Hayasakapora* cf. *erectoradiata* Sakagami, 1960, previously reported from Japan, and the similarity of new species of bryozoans with those previously described from Japan, China and Russia supports the idea that these rocks were originally deposited in the southeastern or central western Pacific Ocean and subsequently accreted to the North American Plate.

Bryozoans and previously reported fusulinids indicate that the biohermal bank is latest Wordian (Kazanian). Several attempts to find conodonts in these rocks were unsuccessful.

Ovicell pores and complex frontal wall pore sieve plates in microporellid species in southern California

Dorothy F. Soule

Hancock Institute for Marine Studies, University of Southern California, Los Angeles, California, 90089-0371, United States of America

Penny A. Morris

Natural Sciences Department, University of Houston-Downtown, One Main Street, Houston, Texas 97002 United States of America

Henry W. Chaney

Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, California 93105, United States of America

New studies of the species of the genera *Microporella* Hincks, 1877, and *Microporelloides* Soule, Chaney and Morris, 2003, from the northeastern Pacific to the Gulf of California, south to the Galapagos Islands and west to the Hawaiian Islands show that all of the eastern Pacific species examined have ovicells with numerous pores closely similar to pores in the frontal wall. This contrasts with the lack of pores in ovicells of fenestrulinids except for the ribbed pores at the margin of the ovicell hoods or the few small, scattered pores that occur in *Microporella* from the Atlantic, Mediterranean and polar regions. A comparison occurs within the *Parasmittina*, wherein Eastern Pacific species have numerous relatively large ovicell pores whereas these do not seem to occur in species in colder northern waters, or in the Atlantic or Mediterranean. Some of the southern California microporellid species also possess complex calcareous sieve plates that appear to originate in the primary calcified layer of the frontal wall. The secondary layers of calcification retain the shape of the pores intact, although there seems to be no interior calcareous rim to define that shape throughout the thick layers. In contrast, the three species of *Microporelloides* in the eastern Pacific from Washington to southern California that lack frontal wall pore sieve plates have thinner frontal walls and pores are not deeply sunken.

All of the microporellid species south of California in Baja California, the Gulf of California and the only microporellid in the Hawaiian Islands lack these complex pore plates. The pores are smaller and the frontal walls thinner in some species but not in others. In fenestrulinids from the coastal waters the pore structures are near the frontal surface and, while sometimes of complex pattern, the branching seems more random and less symmetrical. We have been unable to find pore plates in fossil microporellid specimens from the Pleistocene and Pliocene in southern California but Recent material that has been tumbled on shell fragments and stones are sometimes missing pore plates over much of the colony so they are seemingly more fragile and subject to destruction. The questions open to discussion include the origin and geographic extension of the larger, more numerous ovicell pores, the distribution of the sieve plate character, the possible ecological stimulus for production of the pore plates and the potential evolutionary implications of the characteristics.

Bryozoan exchange: Bassler and Hastings

Mary E. Spencer Jones

Department of Zoology, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK

JoAnn Sanner

Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, DC 20650-0121, USA

Carmen S. Thomas

Department of Zoology, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK

During the 1930's material and photographs were exchanged between Anna Hastings of the Natural History Museum, London and Raymond Bassler of the National Museum of Natural History in Washington DC. Hastings dispatched mainly *Challenger* and *Rattlesnake* material from the collection of George Busk, which were considered to be duplicates. In return Bassler sent *Albatross* material, relevant to works by himself and Ferdinand Canu, mainly from the Philippines, Hawaii and Mexico. A review of the exchange and the material is presented.

Biodiversity Aysén, southern Chile: a preliminary bryozoan report

Mary E. Spencer Jones

Department of Zoology, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK

Biological studies in the fjordic region of Aysén, southern Chile are sparse; Charles Darwin being one of the few to have visited the area. Over a period of five years (1998-2003) during summer months, intertidal and subtidal fauna were sampled as part of a biodiversity initiative for Corporacion Nacional Forestal (CONAF). Intertidal bryozoan diversity was low due to environmental factors, such as salinity. Large kelp in the lower eulittoral and sublittoral fringe were found to be key bryozoan habitats. Preliminary findings and conclusions are discussed.

History of freshwater bryozoology in the United Kingdom and Ireland

E. Spencer Jones

Department of Zoology, The Natural History Museum, Cromwell Road, London, SW7 5BD, United Kingdom

George Allman is probably the most well known of the British and Irish freshwater bryozoologists, his 1856 monograph, which included British and foreign species, remaining a pivotal work in the study of the Phylactolaemata. Many others, however, contributed to our knowledge of freshwater bryozoans. A brief biographical overview of the main British and Irish workers is presented.

Freshwater Bryozoa of Italy I - A survey of the Italian bryozoan collection of A.Viganò

Maria Illuminata Taticchi

Dipartimento di Biologia Animale ed Ecologia – Università di Perugia. Via Elce di Sotto 06100- Perugia. Tel. +39 75 5855705. E-mail tapa@unipg.it

In Italy, the taxonomical and biogeographical studies on freshwater Bryozoa were interrupted in 1972 with the sudden death of Antonio Viganò.
Thirty years later, I decided to resume these researches. My aims were to extend the taxonomical knowledge on Italian Bryozoa and identify which species are intermediate hosts of *Tetracapsula bryosalmonae*, the cause of PKD (Proliferative Kidney Disease) in salmonid fish (Caffara et al.2002).

The research started with a reorganization of the collection and with the revision of the existing classification (including that made in 1974 by Wiebach). In this work, I present some interesting findings carried out by using scanning electron microscopy (SEM) to reveal microarchitectural details of statoblasts. In addition to the species previously reported by Viganò (1964, 1965, 1966, 1968), I identified *Plumatella rugosa* and *Plumatella reticulata*, unknown for Italy, and *Victorella pavida* (Jebram wrote in a personal communication in 1976 that it could be *Tanganella muelleri*) and *Plumatella geimermassardi* n.sp, described by Wood (in print).

Preliminary overview of the cheilostome bryozoan *Microporella*

Paul D. Taylor

Department of Palaeontology, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

Shunsuke F. Mawatari

Laboratory of Systematics and Evolution, Division of Biological Sciences, Graduate School of Science, Hokkaido University, Sapporo 060-0810, Japan

Microporella is a lepralioid cheilostome with a widespread distribution at the present day and a geological range stretching back to the Early Miocene. Almost 150 species have been assigned to *Microporella* but approximately one-third of these belong elsewhere. The morphology of *Microporella* is sufficiently distinctive that the genus is instantly recognizable – the frontal shield is a porous cryptocyst containing an ascopore, the orifice is semi-elliptical in shape, and single or paired avicularia are present proximolaterally of the orifice. However, species identification can be difficult because differences between species are often subtle, sometimes not preserved in fossils, and are seldom recorded in original species descriptions. Several supposedly cosmopolitan species, including the type species *M. ciliata* (Pallas), comprise more than one species, while recent studies have shown that regional diversities of *Microporella* species can be much higher than is at first apparent. In order to clarify the taxonomy of *Microporella* and to investigate evolutionary, biogeographic and morphological patterns in the genus, we have undertaken a global survey of living and fossil *Microporella*. Preliminary findings are presented here. A cladistic analysis of the nine genera belonging to the Family Microporellidae shows the inferred position of *Microporella* within this family.

Biogeographical analysis of Indo-west Pacific Cheilostome Bryozoan faunas

Kevin J. Tilbrook

Earth and Oceanic Sciences Research Institute, Auckland University of Technology, Private Bag 92006, Auckland 1020, N.Z.

Scientific Associate, Department of Zoology, The Natural History Museum, Cromwell Road, London, SW7 5BD, U.K.

Sammy De Grave

Oxford University Museum of Natural History, Parks Road, Oxford OX1 3PW, U.K.

A list of cheilostome bryozoan genera (Mauritius, Hawai'i, Philippines, Indonesia, Heron Island, Fiji, Tahiti, Great Barrier Reef, Solomon Islands and Vanuatu) and species (Mauritius, Philippines, Indonesia, Heron Island, Solomon Islands and Vanuatu) was compiled for a number of Indo-West Pacific (IWP) locations. These lists were compiled from previously published bryozoan faunas as well as data recorded by one of the authors (KJT). Totals of 145 genera and 414 species were tallied from these locations for the shallow IWP. These are not exhaustive lists of genera or species from this vast region, as records exclusively from locations other than those listed have not been added. The matrices were subjected to Beals' smoothing and subjected to Detrended Correspondence Analysis (DCA), to assess area similarity/dissimilarity.

This quantitative analysis of both generic and specific data allows some preliminary observations to be made regarding the biogeographical distribution of IWP cheilostome bryozoans. Primarily, there is a split at both the generic and specific levels between the Indian Ocean (Mauritius) and Pacific Ocean bryozoan faunas. Within the Pacific Ocean, an Hawaiian split is supported, congruent with the biogeography of other taxa. Secondarily, a central western Pacific group of faunas is highlighted. This constitutes, at the generic level, Indonesia and the Philippines with the addition of the Solomon Islands at the species level.

The Solomon Islands are grouped with Tahiti and Fiji at the generic level. This difference in faunal grouping might be due to the respective timings of cladogenesis at the generic and specific levels, generic data reflecting an older affinity. Some processes that may have led to the observed results are discussed. For the most part, however the observed biogeographical patterns seen in the IWP cheilostome bryozoans can be explained by the integration of tectonic events, changes in sea level, vicariant events and dispersal events.

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Bryozoan faunas from the Neogene of Moravia (Czech Republic)

Norbert Vávra

Institut für Paläontologie, Universität Wien, Geozentrum, Althanstrasse 14, A-1090 Wien, Austria

Within a current project („Bryozoan sediments in Cenozoic tropical environments"), supported by the "Fonds zur Förderung der wissenschaftlichen Forschung" (P 15600) bryozoan faunas from the Neogene of the Northern part of the Vienna Basin and of the Carpathian foredeep have been studied. The main goal of these investigations are comparisons of bryozoan faunas from different parts of the (Central) Paratethys area, a modern documentation of various localities in respect to their biostratigraphy, sedimentology and geochemistry as well as a detailed study of the local accumulation of bryozoan material yielding sediments like the bryozoan "reef" at Podbrezice. A detailed report about this carbonate buildup will be given by ZAGORSEK (this conference). Bryozoa from the Moravian part of the Vienna Basin have already been studied by REUSS and PROCHAZKA in the 19th century: relocating such "classical" bryozoan localities is one additional aspect of this project. At least ten taxa of cheilostomatous bryozoa have their type locality in this area, among them such well-known species like *Adeonellopsis coscinophora, Celleporaria polythele* or *Schizoporella tetragona*. A large number of localities mentioned in the literature having been lost, studies of material at the Natural History Museum (Vienna) remained the only one possibility to revise these faunas too. Among those localities being identified, but not yielding bryozoan material any more, is also the locality "Porzteich"; bryozoan material from this place had been described in detail by CANU & BASSLER (1925) and partly revised by DAVID & POUYET (1974).

New material could be collected however at Bischofswart (now: Hlohovec) a locality representing an unusual rich mass occurrence of Celleporids being also interesting because of various encrusting cheilostomes (*Schizoporella, Umbonula*). Summarizing the results achieved until now, on the basis of material kept in various public collections as well as by means of recently collected bryozoan faunas a rather detailed overview of bryozoan faunas from Southern Moravia can be given. As a result of extensive field activities more than one hundred taxa from 13 localities have been studied (K. ZAGORSEK, Narodni Muzeum, Praha); other faunas from a number of "classical" localities (*e.g.* "Porzteich", "Kimberk" etc.) have been revised on the basis of various collections kept at different museums resp. in the author's collection at the Department of Palaeontology (N. VAVRA). By means of studies of foraminiferal assemblages and calcareous nannoplankton (K. HOLCOVA, Charles University, Praha) the biostratigraphical position has been confirmed for a number of localities as Early Badenian (Middle Miocene). All these data offer a reasonable basis for detailed comparisons with bryozoan faunas from various other parts of the Paratethys as described from Hungary, Rumania, Slovakia and Austria.

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Taxonomy and distribution of *Bugula* (Gymnolaemata: Anasca) in Rio de Janeiro state, Brazil

Laís Vieira Ramalho

Museu Nacional – Depto. de Invertebrados – Laboratório de Porifera. Quinta da Boa Vista s/n, São Cristóvão. 20940-040 Rio de Janeiro, RJ – Brasil.

Instituto de Estudos do Mar Almirante Paulo Moreira – Depto. de Oceanografia – Divisão de Biologia. Rua Kioto 253, Praia dos Anjos, 20930-000 Arraial do Cabo, RJ – Brasil.

Guilherme Muricy

Museu Nacional – Depto. de Invertebrados – Laboratório de Porifera. Quinta da Boa Vista s/n, São Cristóvão. 20940-040 Rio de Janeiro, RJ – Brasil.

Bugulids have unilaminar, erect and branching colonies, with zooids uniserial or multiserial and alternate; the avicularia are pedunculate and ovicells are hyperstomial and globular. So far, seven species of *Bugula* Oken, 1815 were recorded in Brazil. However, this genus is almost unknown in Rio de Janeiro state, where only a single species is known, *B. neritina* (Linnaeus, 1758). In this study we investigate the taxonomy and distribution of the genus *Bugula* Oken, 1815 in 3 localities in Rio de Janeiro state, SE Brazil. Samples were collected through SCUBA diving from 0-20m depth in natural and artificial substrates. Specimens were deposited in the Bryozoan collection of Museu Nacional, Universidade Federal do Rio de Janeiro. Five species of *Bugula* were identified: *Bugula neritina, B. stolonifera* Ryland, 1960, *B. uniserialis* Hincks, 1884, *B. carvalhoi* Marcus, 1949, and *B.* cf. *dentata* Lamouroux, 1816. *Bugula neritina* has colonies orange to purple, avicularia absent and up to 4 cm; it grows on artificial substrates such as nylon ropes, concrete pillings, ship hulls, and buoys, from 0-6m depth. It has been collected in Arraial do Cabo, Guanabara Bay, and Sepetiba Harbour. *Bugula stolonifera* has white colonies up to 1.5 cm high. It is epibiont over hydrozoans and other bryozoans, from 0-6m depth. It is known from Arraial do Cabo and Sepetiba Harbour. *Bugula uniserialis* has white or light-yellow colonies up to 0.6cm in high. It grows over seaweeds (*Sargassum furcatum* Küetzing, and an unidentified calcareous seaweed), from 4-5m depth, in Arraial do Cabo. *Bugula carvalhoi* has white colonies up to 2cm in high. It grows over plastic substrates, from 4-5m depth, in Arraial do Cabo. *Bugula* cf. *dentata* has green to green-blue colonies up to 4cm high and 5.5cm wide. It colonises rocks and the hull of a shipwreck in Arraial do Cabo. Four species are new records for Rio de Janeiro state (*B. stolonifera, B. uniserialis, B. carvalhoi, and B.* cf. *dentata*), and one is a new record for the Brazilian coast (*B. dentata*). Due to its world geographic distribution (South Africa, Oceania and Japan), its distribution in Brazil apparently restricted to Arraial do Cabo and the possibility of antropogenic dispersion (as is known in other *Bugula*), it is likely that *Bugula dentata* has been introduced in Brazil. Alternatively, it could be a cryptic, yet undescribed species, morphologically very similar to *B. dentata*. Detailed morpholgical studies are being done to test these hypotheses.

Bryozoans from Sepetiba Harbour, Rio de Janeiro, Brazil

Laís Vieira Ramalho

1. Museu Nacional – Depto. de Invertebrados – Laboratório de Porifera. Quinta da Boa Vista s/n, São Cristóvão. 20940-040 Rio de Janeiro, RJ – Brasil.

2. Instituto de Estudos do Mar Almirante Paulo Moreira – Depto. de Oceanografia – Divisão de Biologia. Rua Kioto 253, Praia dos Anjos, 20930-000 Arraial do Cabo, RJ – Brasil.

Guilherme Muricy

Museu Nacional – Depto. de Invertebrados – Laboratório de Porifera. Quinta da Boa Vista s/n, São Cristóvão. 20940-040 Rio de Janeiro, RJ – Brasil.

Sepetiba Harbour, located in Rio de Janeiro state, SE Brazil, receives large ships which transport ore, oil, containers and steel, ayeraging 300 ships per year. This harbour was selected for the execution of Globallast program (www.globallast.imo.org) in Brazil. Globallast has among its aims the qualitative inventory of the harbour biota, with the purpose to identify possible non-indigenous species. The samples were made during three weeks, late November to early December, 2001, under the general co-ordination of Instituto de Estudos do Mar Almirante Paulo Moreira and with the support of Capitania dos Portos and Universidade Federal Rural do Rio de Janeiro. Quadrats of 0,1 m_ were scraped clean in three different depths (0.5, 3.0 and 7.0 m) in artificial substrates (26 points) and natural substrates in Sepetiba bay (not analysed here). Eighteen bryozoan species were identified: *Aetea sica* (Couch, 1844), *Bugula neritina* (Linnaeus, 1758), *B. stolonifera* Ryland, 1960, *Scrupocellaria bertholletii* (Audouin, 1826), *S. cornigera* (Pourt, 1872), *Membranipora tuberculata* (Bosc, 1802), *M. savartii* (Audouin, 1926), *Schizoporella errata* (Waters, 1878), *Hippodiplosia pertusa* (Esper, 1796), *Savignyella lafontii* (Audouin, 1826), *Microporella ciliata* (Pallas, 1766) var. *coronata* (Audouin, 1826), *Bowerbankia caudata* (Hincks, 1889), *Buskia socialis* Hincks, 1887, *Amathia distans* Busk, 1886, *Sundanella sibogae* (Harmer, 1915), *Nollela stipata* Gosse, 1855, *Crisia pseudosolena* (Marcus, 1937) and *Crisidia* sp. Some of these species were already known from port environment: *Schizoporella errata, Bugula neritina, B. stolonifera* and *Amathia distans*, sometimes considered as non-indigenous species. Seven species are new records for Rio de Janeiro state (*Aetea sica, Bugula stolonifera, Hippodiplosia pertusa, Microporella ciliata* var. *coronata, Nollela stipata, Scrupocellaria bertholletii* and *Savignyella lafontii* and one genus is a new occurrence in the Brazilian coast (*Crisidia* sp. 1). The shallowest samples (0.5 m) showed the greatest richness (17 species) and the two other depths (3 and 7m) were similarly less rich (11 and 13 species, respectively). Eight species occurred in the three depths (*B. neritina, B. stolonifera, B. socialis, S. errata, S. cornigera, S. lafontii, M. savartii* and *C. pseudosolena*), four occurred only at 0.5 m depth (*B. caudata, H. pertusa, N. stipata* and *M. tuberculata*), and two occurred only at 3 m (*S. sibogae* and *A. distans*). The results, although preliminaries, showed, for the present, that the Sepetiba fauna is very diverse and that some species, apparently, exhibit different distribution pattern along depth and sites.

Early Permian reefs form the southwestern Tethys (Batain region, Sultanate of Oman) - Cool-water evidence confirmed by bryozoan paleogeography, biotic composition, and reef taphonomy

Oliver Weidlich

Institut für Geowissenschaften, Christian-Albrechts-Universität, Olshausenstrasse 40-60, D-24118 Kiel, Germany; HIPERVÍNCULO „mailto:ow@gpi.uni-kiel.de" ow@gpi.uni-kiel.de.

Andrej Ernst

current address: Geologisk museum, Universitetet i Oslo, Pb. 1172 Blindern, N-0318 Oslo, Norway; „mailto:ae@gpi.uni-kiel.de" ae@gpi.uni-kiel.de.

Priska Schäfer

Institut für Geowissenschaften, Christian-Albrechts-Universität, Olshausenstrasse 40-60, D-24118 Kiel, Germany; "mailto:ps@gpi.uni-kiel.de" *ps@gpi.uni-kiel.de*

The southwestern Tethys represents a realm of prolific reef growth during the Early and Middle Permian. This period is also characterized by the global change of climate from icehouse to greenhouse. Far-reaching consequences of global warming concerned marine depositional systems with respect to taxonomy and taphonomy of the carbonate-secreting metazoans, the cementation patterns, and the overall depositional geometries of the carbonate shelves. The reefs of the southern Tethys track these mentioned changes, especially reef blocks of the Batain basin, which formed a part of the collapsed shelf rim of the Neo-Tethys. The following criteria proof our cool-water hypothesis:

(1) "Reef framework" and taphonomic processes: A "rigid" reef framework is poorly developed or even absent due to missing incrustation and cementation phenomena typical for tropical reefs (see below). Prevailing sediment types are, therefore, wacke/floatstones and grain/rudstones. All metazoans show signs of reworking or limited lateral transport.

(2) Bryozoan taxonomy and biogeography (determination by A. Ernst): *Alternifenestella basleoensis* (Bassler 1929), *Minilya horologia* Bretnall (1926), *Fistulipora crescens* Crockford 1944, *Rhabdomeson bispinosum* Crockford 1944, *Goniocladia* cf. *cyclopora* Shulga-Nesterenko 1933, *Streblascopora marmionensis* (Etheridge; *in* Bretnall 1926), *Hinganela bella* (Crockford 1957) exhibit close paleogeographic connections to regions of fairly high latitides, notably western Australia. Thus, they are regarded by our working group as proxy taxa for cool-water conditions.

(3) Reef types and reef builder diversity: Lower Permain blocks are exclusively remnants of bryozoan reefs. The associated fauna comprises only crinoids, brachiopods, some smaller foraminifera, and rare opportunistic coralline sponges (*e.g.*, *Sollasia ostiolota*). There is no evidence for contemporaneous tropical reefs: rugose coral reefs or coralline sponge reefs have not been found hitherto.

(4) Microbial carbonates: A further striking feature of the cool-water reef blocks is the absence of calcimicrobes and microbial micrite, which form volumetrically important constituents of tropical reefs.

(5) Cementation patterns: Fibrous cements rimming interparticle and shelter pores are common. However, botryoids are absent and cements are volumetrically less important as compared to sponge or coral reefs.

The presence of cool-water carbonates during the Early Permian in the Batain basin and their subsequent demise during the Middle Permian is predominately controlled by the continuous northward drift of Gondwana from relatively high latitudes into the equatorial realm.

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A New Encrusting Interstitial Bryozoan Fauna from Brazil

Judith E. Winston

Virginia Museum of Natural History, 1001 Douglas Avenue, Martinsville, VA 24112, USA

Alvaro Esteves Migotto

Centro de Biologia Marinha, Universidade de São Paulo, Caixa Postal 83, São Sebastião, SP, Brazil

In the early 1980s, a study of the population biology of two species of free-living bryozoans inhabiting Capron Shoal, a high energy shoal off the east coast of Florida, led to the discovery of a new and apparently unique habitat for encrusting bryozoans on single sand-size grains of shell or mineral (Winston and Håkansson 1986). The larger grains (in the coarse sand to gravel class) in the samples supported additional encrusting bryozoan species, many of them also present on whole dead shell "island" substrata in the vicinity of the shoal. It seemed possible that this interstitial refuge could help explain how encrusting organisms with short-lived non-feeding larvae (like most bryozoans) could maintain remarkably broad distributions. However, it remained to be seen whether such habitats occurred anywhere but this one shoal. A second instance of an interstitial encrusting fauna, this time from the continental shelf off Carraguatatuba, Brazil, was has recently been discovered during a survey of the marine fauna of the state of São Paulo, being carried out by scientists from the Centro de Biologia Marinha of the University of São Paulo. In this area, sand-bottom habitats support an invertebrate macrofauna that includes cupuladriid bryozoans, echinoderms, and bivalve and scaphopod mollusks. Sorting of the sediments under a dissecting microscope revealed many sand grains to be encrusted by tubeworms and a variety of bryozoans. Most abundant (with about1300-1500 colonies/$m^{2)}$ was a new species of *Cleidochasma*. A new *Trypostega* species, and a new *Reginella* species, were also common, with up to 200-300 colonies/m^2 at the stations sampled. Also very common in the samples were colonies of the boring bryozoan species described from Brazil by Marcus (1938). These and the other encrusting cheilostome species found in the samples are described here.

The Higher Phylogeny of Phylactolaemate Bryozoans Inferred from 18S Ribosomal DNA Sequences

Timothy S. Wood & Michael Lore

Department of Biological Sciences, Wright State University, Dayton, OH 45435 USA

Freshwater bryozoans (Phylactolaemata) are classified among five distinct families. Comparative morphology among all families suggests a linear series, from simple to complex, that is generally thought to reflect an evolutionary trend. We sought to test this hypothesis using partial 18S rDNA sequences from 8 species representing five families, rooted with 2 species of Cnidaria. Genetic variation among the bryozoan species was small. The two monotypic families, Cristatellidae and Pectinatellidae, displayed twice the number of mutation events as all other species combined. Parsimony analysis could not be used to analyze the sequences due to the lack of sufficient informative sites. Maximum likelihood and distance matrix analyses both suggest a new phylogenetic tree that runs contrary to the traditional view. Nearest the outgroup are all globular colonies with large, hooked statoblasts and large lophophores. At the top of the tree are the branching, tubular colonies, with small statoblasts and smaller lophophores. These results cloud the already subjective view of phylactolaemates related in some way to the ancient marine Stenolaemates or Ctenostomes, both of which exhibit tubular colonies. In fact, the aligned DNA sequences of phylactolaemate bryozoans show greater similarity to phoronids than to gymnolaemates. They also suggest unexpected evolutionary trends among phylactoplaemate statoblasts: spiny, self-inflating statoblasts of Pectinatellidae and Cristatellidae appearing early, followed by the general morphological simplification of Plumatellidae and Fredericellidae.

Phylactolaemate bryozoans and a new freshwater entoproct from Asia

Timothy S. Wood

Department of Biological Sciences, Wright State University, Dayton, OH 45435 USA

Several months of field work in the Republic of Korea and Thailand coupled with a thorough examination of the phylactolaemate collection at the Indian Museum (Calcutta) have resulted in a clarification of many phylactolaemate species, including several synonymies and the recognition of at least six new species. Among the more interesting findings are that both *Internectella bulgarica* and *Hyalinella lendenfeldi* are fairly abundant in Thailand. Colonies of *Hyalinlella lendenfeldi* share similar colony features with *Hyalinella punctata*, and these currently are probably the only valid species in the genus. A new freshwater entoproct from west central Thailand appears to be most closely allied with the *Loxosomatoides*: its habitat is truly fresh water (not brackish), and there is a hibernaculum. The Indian Museum has good type specimens of *Plumatella bigemmis, P. longigemmis, Stolella indica*, and *Australella indica,* which in some cases do not agree with published descriptions of these species. No justification could be found for the genus *Australella*. The range of *Hislopia* was expanded northward to include Korea (Busan), but the various reported species of *Hislopia* could not be verified. Previously reported species from southern Asia apparently resulting from misidentifications include *Plumatella fruticosa, P. toanensis*, and *Lophopodella pectinatelliformis*.

Biodiversity of epifauna associated with bryozoan thickets from the Otago shelf, south-eastern New Zealand

Anna C. L Wood, P. Keith Probert & Abigail M. Smith

Science, University of Otago, P.O. Box 56, Dunedin, New Zealand

Frame-building bryozoans are a conspicuous epibenthic component of the Otago continental shelf, south-eastern New Zealand (45°S, 170°E) with highest densities found at water depths of 75 to100 m. Their distribution is patchy, and positively correlated with coarse substratum, strong currents, sediment-stabilising fauna and positive seabed relief.

The three largest species of bryozoans found on the shelf have very different, but characteristic colony forms. The cheilostomate *Hippomenella vellicata* forms approximately spherical, erect rigid foliose colonies which contain numerous sheltered voids and typically grows to 100 mm in diameter. Another cheilostome, *Celleporaria agglutinans,* forms dense multilaminar clumps, often with chimneys, typically growing to 200 mm in diameter. The cyclostomate species *Cinctipora elegans* forms dense bushes of near-vertical cylindrical branches and grows to approximately 70 mm in height. All three species provide habitat for a diverse invertebrate fauna and shelter for small fish.

Samples were collected from the Otago shelf by dredging bimonthly over six months. Three live colonies of each species were collected on each occasion and individual colonies were preserved in formalin. Gross colony morphometrics were recorded before associated fauna (retained on 1 mm mesh) were removed and identified.

Here we will discuss whether different species of Bryozoa support different faunal communities, and how diversity of associated fauna varies with colony form. This research will enable better understanding of some benthic processes occurring on the Otago shelf, including species associations and interactions, habitat requirements of invertebrate species and the potential impacts of activities such as commercial trawling.

The distribution of freshwater bryozoans in Austria

Emmy Wöss

Institute of Ecology and Conservation Biology, Althanstraße 14, A-1090 Vienna, Austria

This survey deals with the geographical distribution of freshwater bryozoans in Austria. Nine of the ten species recorded so far belong to the class of Phylactolaemates and within this group the majority can be assigned to the family of Plumatellidae (*Plumatella casmiana, P. emarginata, P. fruticosa, P. fungosa, P. repens* and *Hyalinella punctata*). The Fredericellidae and Cristatellidae are each represented with one species (*Fredericella sultana* and *Cristatella mucedo).* However, rare freshwater bryozoans such as *Lophopus crystallinus* (Lophopodidae) are reported as well. The class of Gymnolaemates is present exclusively by *Paludicella articulata.*

As freshwater bryozoans normally do not overwinter, colonies can usually only be found during a limited period of the year. In this study findings from colonies as well as from overwintering stages such us statoblasts and hibenaculae are included. Additionally the reliability of the latter sampling method is tested in 15 waterbodies by comparing species lists given on basis of colony material versus statoblasts.

Bryozoan settlement in borings of the Common Piddock (*Pholas dactylus*) from the east coast of Ireland

Patrick N. Wyse Jackson & Dino Gandara Rai

Department of Geology, Trinity College, Dublin 2, Ireland

Borings in stone, firm mud or wood can be produced by a variety of marine organisms including sea urchins, ship worms, and members of the bivalve family Pholadidae. *Pholas dactylus*, the Common Piddock, occurs moderately widespead around the southern coasts of Ireland and Britain, and readily bores for protection into limestone, sandstone or chalk, and occasionally into peat or wood. It comprises two identical elongate shells up to 3 cmin length which are highly ridged on their outer surfaces which facilitates their boring habit. Pholas produces a flask-shaped chamber that reaches 4 cm in depth and approximately 1 cm in diameter.

For a study of the encrustation by bryozoans of these borings, sixeen cobbles of Lower Carboniferous limestone were collected in April 2003 from the foreshore at Bray, County Wicklow, eighteen miles south of Dublin on the east coast of Ireland. All exhibited boring by Pholas dactylus – the density of boring ranged from slight to heavy, and it was clear that some cobbles had been rolled over several times as borings occurred on all surfaces. While most cobbles were encrusted by serpulid worms, in additionten bryozoans species including Electra pilosa, Reptadonella violacea, Pentapora foliacea, and the cyclostome Plagioecia sarniensis were alsofound. Bryozoans didn't encrust the outer surfaces of cobbles were they would have been subjected to strong water currents and possible abrasion due to the knocking together of adjacent cobbles, but occurred in the more sheltered niche inside the borings. Settlement occurred in two distinct regions: either around the neck of the chamber, or towards or in its base

It is possible that encrustation of the latter position could have occurred when the chamber of still inhabited as the presence of the bivalve's syphons would not necessarily have inhibited bryozoan growth, whereas encrustation at the base could only have occurred once the bivalve had died and the shell had been lost. The percentage area of the borings encrusted by bryozoans is rarely over 10%.

An exceptionally preserved bryozoan fauna from the Carboniferous (Mississippian, Upper Viséan) of Germany

Patrick N. Wyse Jackson

Department of Geology, Trinity College, Dublin 2, Ireland

Hans Martin Weber

Weg 29, D-51429 Bergisch Gladbach, Germany.

During a recent assessment of the geological and scientific importance of a construction site at Velbert in the Rhenish Massif in Germany, a Lower Carboniferous (Upper Viséan) fauna was recovered. Situated in the north-north-east portion of the Velbert Anticline, this section exposed shallow water limestones that indigitate with deeper water shales typical of Culm facies. The limestone displayed small karstic features; within one small cavity, loose debris lined the floor. On microscopic examination this material was found to comprise a highly diverse and exceptionally preserved silicified microfauna.

The fauna contains twelve to fifteen foraminifera genera which include textulariids with preserved foramina. Over six hundred ostracod valves were recovered that belong to as many as twenty genera. Rare juvenile trilobites, gastropods and bivalves are also present, as are sponge spicules and calcareous algae. The bryozoans are diverse and beautifully preserved. Delegate cryptostomes include the taxa Pseudonematopora and Nematopora, fenestrate genera include the distinctive Rhombocladia and Thamniscus, numerous fenestellids including Fenestella s.l. ivanovi, and smaller pinnate forms including Diploporaria and Penniretepora. One species of the latter is unusual in that it forms secondary branches of two morphologies. Cystoporates are rare, as are trepostomes that usually form small adnate expansions. A number of delegate cryptostomes may represent new genera.

This fauna shows most similarities with that described from the Glencar Limestone of north east Ireland which has yielded 29 bryozoan genera of Viséan age.

Development of Badenian Bryozoan fauna in Podbrezice (south Moravia, Czech Republic): from reef to meadow

Kamil Zágorsek

National Museum, Václavské nám. 68, CZ-115 79 Praha, Czech Republic

Katarína Holcová

Faculty of Science, Charles University, Albertov 6, CZ-120 00 Praha, Czech Republic

Bryozoa dominant sediments are rather common in Parathetys during Miocene. They can be found in Hungary (among others in localities Szentkút, Fót, Kemence, etc.), Czech Republic (mainly in the locality Podbrezice and Práteck_ vrch), Rumania, Poland, Slovakia, Austria etc. We have focused on the bryozoan locality Podbrezice, where succession from reef to basin deposit can be studied.

Village Podbrezice is situated near Rousínov (district of Brno, south Morava, Czech Republic). There are two localities with different development of sediments. The older, bryozoan limestone formed a buildup is situated on the south slope of the small hill eastern from the village Podbrezice. The younger, bryozoan marl to clay is situated close to the center of the village. There is no detailed published study of these localities.

The bryozoan buildup in Podbrezice is recently more than 6 meters high and, with present study, eight layers can be separated. Five of them are massive (from 60 to 220 cm thick) consisting of sand to sandstone with many celeporids bryozoans. The massive bryozoans layers are separated by 3 thin more marly layers, which are 10-15 cm thick. The frame of the bioherm complex is composed by celeporids colonies, mostly 3-7 cm in diameter. Beside celeporids, altogether more than 100 species of Bryozoa were determined. Among them dominated cyclostomatous Bryozoa: *Pleuronea pertusa* and *Ybseloecia typica*.

Study of foraminifers proof the age of the studied sediment as Lower Badenian and according to dominance of epiphytic taxa (*Asterigerinata planorbis*) proposed the original paleoenvironment as upper neritic, stenohaline, well-aerated normal sea condition. Composition of foraminifers assemblages in section are similar, assemblages differ only by preservation of foraminiferal tests: abundance of abraded, corroded and broken tests indicating bed-load transport (higher energy) increases upwards from the middle of the profile (layer number 6) to its top.

Increase of the water energy upwards proof also decreases of bryozoan's diversity and dominance of flexible erect forms (*Cellaria fistulosa*), which flourished also in higher water energy environment.

Bryozoan marl to clay locality in Podbrezice is characteristic by dominance of *Myriapora truncata* and *Metrarabdotos malecki*. Altogether more than 60 species of Bryozoa were determined.

Study of foraminifers proof the age of the studied sediment as Lower Badenian, but distinctly younger than the buildup sediments and the original paleoenvironment was suggested as neritic, stenohaline, well-aerated normal sea condition. Compositions of foraminifer assemblages are similar, only small amount of abraded, corroded and broken tests was found. Lower water energy proof also increases of diversity of rigid erect bryozoans and dominance of rigid forms as *Myriapora truncata*.

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CONTENTS

IBA MEMBERS. Alphabetic list of all presentations to the 13th IBA Meeting in Concepcion, Chile 7

IBA MEMBERS. Programme of the 13th IBA Conference, Concepción, Chile, January 2004..... 13

IBA MEMBERS. Poster presentaions..... 20

HUGO I. MOYANO G., JUAN M. CANCINO & MARIA CRISTINA ORELLANA: Chilean Bryozoology..... 23

IBA MEMBERS. Abstracts of talks and posters 35